

STORAGE

REPORT OF OBSERVATIONS

OF

INJURIOUS INSECTS

DURING THE YEAR 1882,

Biological
& Medical
Serials

WITH METHODS OF

PREVENTION AND REMEDY,

AND

SPECIAL REPORT ON WIREWORM.

BY

ELEANOR A. ORMEROD, F.M.S., &c.,

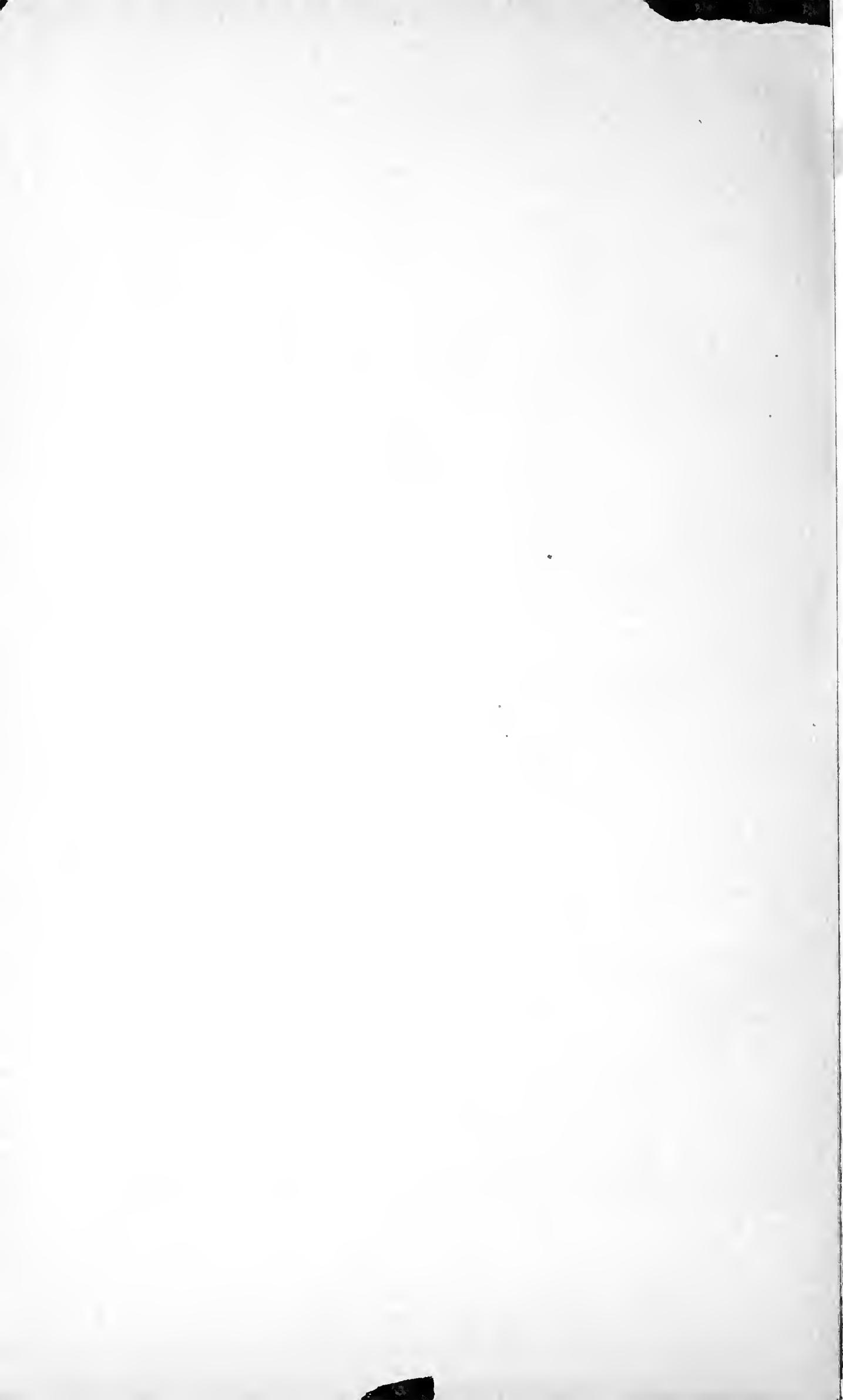
CONSULTING ENTOMOLOGIST OF THE ROYAL AGRICULTURAL SOCIETY; SPECIAL LECTURER ON
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P R E F A C E.

THE season of 1882 was, on the whole, remarkably free from wide-spread attacks of insects occurring to any greatly injurious extent, with the exception of those of Aphides, which were the cause of serious loss, amounting to little less than devastation of the Hop crops.

Reports from many localities, including England, Scotland, and the South-west of Ireland, mention that very little harm was caused by attack, as, in consequence of the weather being generally suitable for plant-growth, the crops held their way under moderate injury; and also the amount of rainfall, or of showers, was unfavourable to the increase of some kinds of insects, and checked the activity by which, in sunshine and drought, many of them spread themselves far and wide. For this reason, although Turnip Fly, the great cause of loss in 1881, made its appearance, the increase did not again become a general disaster.

The chief attacks were those of Apple Weevil on the Apple blossom in the spring, and some bad cases of local injury from Daddy-longlegs grubs; later on the caterpillar of the Winter Moth did much harm to leafage; and the circumstance occurred (very rarely observed in this country) of attack by Cockchafer grubs taking place, to a seriously hurtful extent, on the roots of young Pines in plantations extending over a large extent of country.

Wireworm did much harm in a few localities, but not as a general pest; and there were also local attacks of Clover, Pea and Turnip Weevils, causing much loss to the respective crops; the brunt of the year's attack, however, fell on the Hops. This loss is estimated by Mr. C. Whitehead, of Barming House, near Maidstone, as not less to the Hop planters of the United

Kingdom than £1,750,000 (that is one and three-quarter million pounds sterling) from this year's blight ; with the addition of the loss to labourers of at least £200,000.

Many notes are given of loss by Wireworm, but just taking a few of these one gives a loss at the rate of 2 quarters per acre over a 17 acre field of Barley, this amounting at the then market-price to £3 per acre, or a total of £51 ; another gives a deficiency on 15 acres of Wheat, estimated at £8 8s. per acre, consequently £126 on the field ; and an estimate of the money loss in an average of seasons on 350 acres of a 1000 acre farm, in Hampshire, is given as £2 per acre, that is £700 loss yearly.

Loss by Weevil attack to Peas is estimated in one case as not less than £20 on 6 acres ; in another case as not less than £50 on 9 acres, besides further loss on deficiency of straw, &c., estimated at £20 more ; and there is also an estimate of loss by weevil on 2 acres of Vetches amounting to £20.

Many other notes of loss are given, and each year's Reports show more and more the heavy losses that occur ; but they show at the same time that in many cases they may be much lessened by measures falling within the common course of husbandry.

Cleaning the ground well beforehand, and destroying weeds and rubbish which shelter the insect vermin (and which in any case are better away), act at once towards lessening the numbers of some of our worst pests ; and the good husbandry which grows a hearty crop very much lessens the effect of attack in any case. This matter may seem so plain as not to be worth mentioning, but the practice long held its ground, and often does so still, of neglecting all care until the enemy is in possession, and then too often it happens that to the loss of the crop there is to be added also the outlay for applications that did no good. We need to know the method of life of the crop-pest to be able to apply special care serviceably, and it will be seen that some information long needed has been worked out in the past season.

The discoveries of the place of feeding of the Pea and Clover Weevils (*Sitones*) are very important, and new observations have also been made as to Cabbage-root and Onion Flies, Wheat-bulb Fly, Ash-bark Beetle, Pine-bud Moth, and a small Midge-gnat that forms galls in the cone of the Spruce Fir.

It will be noticed (especially in the Wireworm report) that although, as we all know, Rooks are of great service in clearing ground of grubs and Wireworm, that there are drawbacks to

their services in the fact of the bird's researches sometimes destroying as many plants as the grubs do which they are looking for; and I would submit that it is a matter for serious consideration, whether the great encouragement of bird-life *beyond the natural balance*, such as is now often recommended, may not lead to very contrary results to what is intended. Besides the damage that *over-numbers* of birds may cause to the young crops or ripe corn, it ought also to be borne in mind that many insects (such as carnivorous Beetles and their grubs, and the grubs of Ichneumon Flies) live wholly or in part by feeding on their fellow-insects; and it is desirable to consider how an unnatural overplus of birds bears on the matter of diminishing these helpers. Without in any way doubting the necessity of the presence of a proper amount of birds, I think it would be well worth while, by examination of the contents of the stomachs of some of the smaller birds, to gain clearer views of what is the chief part of their insect-diet.

Any notes that I may be favoured with during the coming season, on any point bearing on prevention of injury, will be most thankfully received; and I will venture to suggest that, amongst the communications I am favoured with, none are so valuable as those noted at once whilst the attack is present, or which are then made the subject of correspondence, as many valuable details are thus gained which otherwise might be overlooked.

I shall be most happy to endeavour to offer any information in my power (or which I can obtain) to those who may desire it, and more especially I shall be glad to receive any communication regarding Hop blight.

It now remains for me to offer my hearty thanks to all who have enabled me by their information to compile my present Report; and I have also to thank Prof. J. O. Westwood, Mr. R. H. Meade and Mr. W. L. Distant for kind assistance in determining specimens with which I was not fully acquainted.

A few illustrations, not previously given, have been added, some drawn by myself; and a few of the figures, originally allowed me by the courtesy of the Editor of the 'Gardener's Chronicle,' are again inserted; but the larger number are by permission of Messrs. Blackie & Son, Glasgow, to whom I offer my thanks for the prompt courtesy with which they accord their assistance.

It is with great satisfaction that I can allude to the increase of attention to the subject of prevention of insect ravage during the past season, both at home and in our colonies; and whilst I hope my contributors will be so far satisfied with the Report of their observations as to entrust me again with their notes for a similar purpose, I can earnestly promise that on my part I will gladly give the most careful attention in my power to all communications they may favour me with.

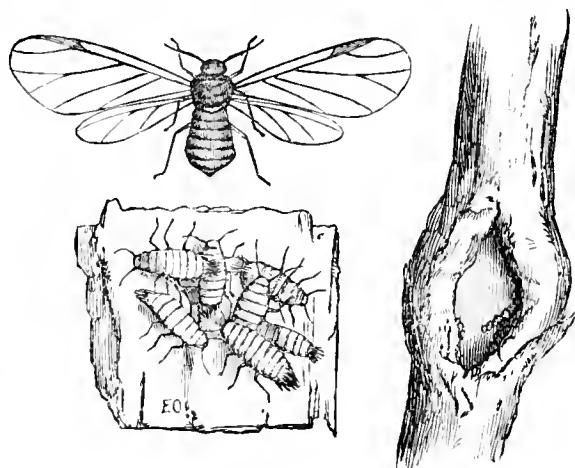
ELEANOR A. ORMEROD.

DUNSTER LODGE, NEAR ISLEWORTH,
March 19th, 1883.

NOTES OF OBSERVATIONS
OF
INJURIOUS INSECTS
DURING 1882.

APPLE.

American Blight; Woolly Aphid. *Schizoneura lanigera*, Hausm.



SCHIZONEURA LANIGERA.

Winged Woolly Aphid, magnified; larvae, much magnified.
Apple twig, with the same larvae, natural size, at the lower part of the infested spot.

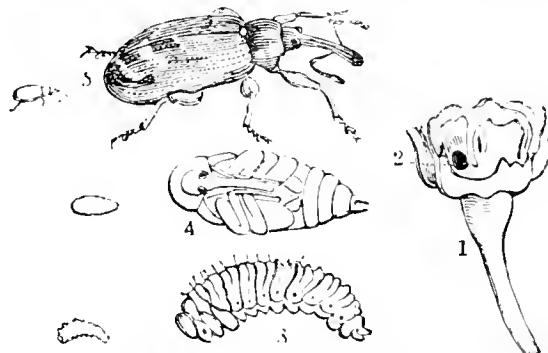
MR. MALCOLM DUNN, writing on the 10th of July from The Gardens, Dalkeith Palace, N.B., mentions, "We are generally not much troubled with American blight in this district, but this year it has broken out rather severely on a few of our Apple trees, and I have destroyed it by washing them with strong soap-suds, in which I put about half a wine-glass of paraffin to a gallon of the suds, and apply with a syringe or the garden-engine."

"I find soft-soap an excellent insecticide, wherever it can be applied with safety to the plant: made into a thick lather, and applied with a stiff brush to the stems of Apple trees infested with 'American Blight,' it is a certain remedy. In the winter, when the trees are at

rest, it may be applied all over the tree ; and if the roots are uncovered from the base of the stem onwards, as far as it is easy to get at them, and the soft-soap is applied to them also, the treatment will go far to stamp out the pest. Even a thorough soaking of the soil in which the roots run, with strong soap-suds, repeated a few times during winter, is a first-rate means of keeping down American Blight ; of course the soft-soap must not be applied (as above) to green leaves or bark : it is so caustic that it invariably burns them, especially if the sun strikes on the soap ; therefore it must be used with caution in summer."

Mr. F. Macey, writing from the gardens at Longmoor, near Forest Gate, mentions that the only attack of injurious insects occurring to any extent was on the Apple trees, which somewhat suffered from American Blight. He remarks, "As mine are pyramidal trees of small size I am able to wash them with a solution of paraffin and water, about one-third of the former to two-thirds water, which I find a certain cure."

Apple-blossom Weevil. *Anthonomus pomorum*, Curtis.



ANTHONOMUS POMORUM.

1 and 2, Apple-bud pierced by weevil ; 3, maggot ; 4, pupa ; 5, weevil : all mag. with lines, showing nat. size.

On the 2nd of May I received specimens of the maggots and chrysalids of the Apple-blossom Weevil from Mr. Edward Frere, of Lucombe, Isle of Wight, with a note of great injury being caused yearly by its attack to the buds of his Apple and Pear trees, just as they were coming into blossom. He observes, "I used to have a great abundance of fruit, both Apple and Pear ; I now scarcely get any, owing entirely to the ravages of this horrid insect."

Mr. T. H. Hart also forwarded specimens of the Weevil in its early stage from near Kingsnorth, Kent, and mentioned that larvæ of these Apple-blossom Weevils had terribly ravaged the Apple blossom, and that scarcely a bunch of flowers was to be found without its destroying tenant. Pinching the discoloured buds, before the

maggot had time to change to the beetle state and escape, was found serviceable, in the case of espaliers in gardens, in clearing off attack for future benefit.

In the orchards round Isleworth and Hounslow there was also much mischief done to the Apple buds by this maggot.

The method of attack is for the female beetle to lay her eggs singly in the unopened blossom-buds of Apples, and sometimes of Pears, and here the maggot soon hatches, and feeds within them, thus soon killing the infested buds, which may be known by the petals or flower-leaves soon withering into a brown cap, instead of expanding. Under this shelter the maggot quickly goes through its changes, first to a chrysalis, then to a small long-snouted weevil of various shades of brown or greyish tint, with sloping bands on the wing-cases. In the following winter the weevils shelter under rough bark, clods of earth, or in any convenient nooks on or near the trees; and with the return of spring they come out again. The common measures of keeping bark in good order, clearing away rubbish, and attending to the condition of the stakes of espaliers and the proper pointing of walls, will all help to keep this pest in check in gardens. The males fly round the branches, but the females are stated rarely to fly, and the weevils fall when they are alarmed; therefore shaking or smartly jarring the branches of infested trees, and throwing a ring of fresh gas-lime, or placing a band of anything convenient soaked with tar round the stem of the tree, or using any other means by which the beetles may be prevented creeping back up the tree to the branches, will be very serviceable.

Winter Moth. *Cheimatobia brumata*, Stephens.



CHEIMATOBIA BRUMATA.

Winter Moth. Male, winged; female, with abortive wings.

The caterpillars of the Winter Moth have been injurious in various localities during the past season. On June 9th they were mentioned as occurring in such great numbers at Bridley Manor, Guildford, as to be ruining the Apples in the nurseries.

Mr. Edward Parfitt, writing from Exeter, mentions them as having been very numerous; and the exceedingly severe attack on the Oaks

at Longleat, near Warminster, appeared, from the specimens forwarded to me on June 19th by Mr. Taylor, to be almost, if not entirely, caused by these caterpillars.

No notes of means of prevention have been sent in, but something might be done to check (at least in garden cultivation) the ravages of this destructive caterpillar, which feeds on the Apple, Pear, and Plum, besides the Oak, Elm, Lime, and many other trees.

The Moths, which come out from chrysalids lying in the earth, appear about the beginning of November; and during November and December the females, not being able to fly, creep up the trees to lay their eggs on various parts of the twigs, or in crannies of the bark. If anything, therefore, is put round the trunk of the tree, which the Moths will stick fast in or will not attempt to cross, its safety from attack (in all cases where it stands apart from others and from supports) is fairly well secured.

Where fruit trees are pruned after December it is desirable that all the small twigs that fall to the ground should be carefully removed, that any caterpillars hatching from eggs on these twigs may not be able to get to the trees.

The caterpillars hatch in spring, and feed first on the young unopened buds or young leafage, and, where they are numerous, clear off every morsel that is eatable on the boughs, webbing some of the remains of the leaves together as they proceed for a shelter. The caterpillars are about half an inch long, and form a loop when walking, very similarly to those of the Magpie Moth (see figure), and the colour is greenish, with a black or blue line along the back, and whitish lines along the sides.

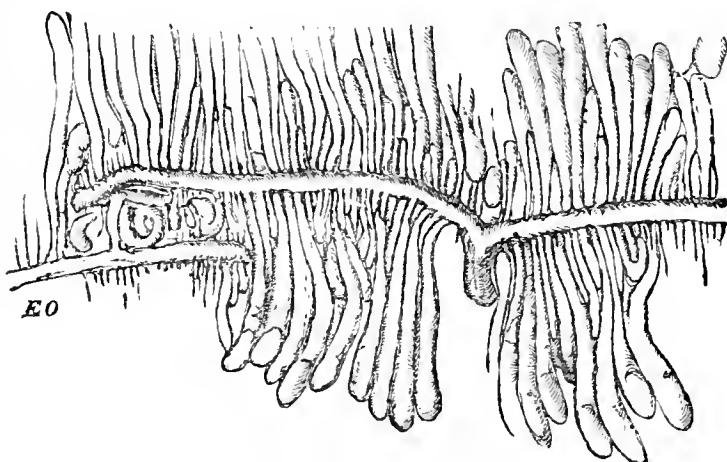
A S H .

Ash-bark Beetle. *Hylesinus Fraxini*, Fab.

The following notes of the habits of the Ash-bark Beetle, *Hylesinus Fraxini*, are from observations taken by Mr. Angus M'Intosh, Llanerch, Llanelly, S. Wales, and amongst other information give the locality of the winter quarters of the beetle.

On March 16th I received specimens of rough, thick, Ash bark, just taken from living trees, bored into by Ash-bark Beetles, which were then still in their winter holes. These bores or tunnels resembled small shot-holes, and ran indifferently up, down, or to either side, but were all single,—that is to say, they were never branched like the

breeding galleries (see fig.); they were seldom more than three times as long as the beetle, and at the end of these tunnels the beetles appear to pass the winter. About the middle of February beetles had been found in them, some alive, though not active, and some dead; and the specimens of bark sent me on March 16th similarly contained Ash-bark Beetles in the borings, some alive, some dead.



HYLESINUS FRAXINI.

Workings of Ash-bark Beetle.

Hybernation appears to begin towards the end of September, as on the 22nd of that month beetles were found making their way into healthy bark; and specimens were forwarded in which the beetles, then developing, instead of having escaped as usual by a hole through the bark at the end of the bores they had eaten out while maggots, were to be found turned in the other direction (in short borings, like the winter ones) into the solid wood.

The beetles infest trees of all sizes for these winter tunnellings, and do much damage in the locality, as they work into healthy, as well as sickly, trees for this purpose; and though they for the most part bore into the bark round the base of dead branches or twigs, or into the young bark forming over the wounds caused by pruning, they do not confine their attacks to these places. They also often work their way into the bark by the side of dead leafless Ivy.

On May 5th more specimens were forwarded to me, taken out of the tunnels where they had wintered in an Ash tree of about fifty years of age; at this date the beetles were beginning to quit their winter quarters, possibly rather later than usual on account of the cold weather in April.

Passing now from the winter borings to the breeding galleries, by May 24th the beetles were well at work at these; some had got the length of half an inch or more with their tunnels, and were now accompanied by their helpmates, and in some cases the pair were at

work in forming the forked part of the gallery, one going to the right and the other to the left,* from the short gallery whereby they entered. The specimens sent were taken from *felled Ash timber*, of which the bark varied from one-eighth to one-fourth inch in thickness, the holes by which the beetles entered, and which appear on the outside like small drillings, being most numerous on the part where the bark was thickest. Measurements were carefully taken as to the thickness of the bark used for breeding galleries, and of these none were found in bark of less than one-eighth of an inch in thickness.

On June 15th the beetles were still laying eggs in some of the galleries, but in some cases these were full of grubs. The beetle was not found boring for *laying purposes* into the growing tree (with the exception of two or three holes, which were begun and deserted), conjecturally because the flow of sap at this time of the year would be injurious to the egg and the grub. Before a tree becomes suitable for a breeding place, it appears requisite that it should be so unhealthy, wholly or in part, that the sap should have almost entirely ceased to flow. At the time of boring the winter tunnels there is little or no flow of sap. (Also the beetle is then in its perfect stage, not in its feeding larval condition.—ED.)

From observations taken it does not appear that attack would be likely to occur to healthy trees unless there were *felled or unhealthy trees* near that were suitable for *breeding places*. From these they pass to other trees, healthy or unhealthy, and by means of the short winter tunnels which they bore into these trees the Ash-bark Beetle is injurious. Soils which from defective drainage, or which from their nature (as cold, stiffish clays), are *unsuitable* for the Ash, by producing *unhealthy* trees produce also breeding places for the beetle. Also the custom, where there are large rough hedges, of laying the Ash, is objectionable, and Ash thus operated on is to be found in some districts much infested by the beetle.

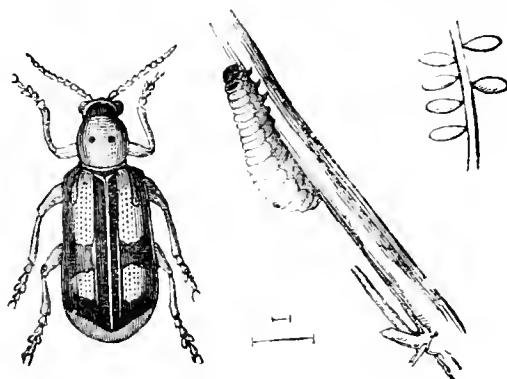
With regard to remedies, the removal of such felled timber, and dead or dying branches as are suitable for the breeding galleries, is

* To complete the history, I may mention from my previous observations that the tunnels noted as carried on to the right and left are continued by the two parent beetles until they are about an inch and a half long (see fig.). The female then lays her eggs near together in a line along each side of the two borings; from these the whitish, legless grubs soon hatch, and each eats for itself a tunnel in the soft inner bark, as nearly at right angles with the mother's gallery as circumstances will permit; but as the grubs grow rapidly, and room is limited, the tunnels of many of the weaker ones and the lives of their tenants are cut short. The successful larvae complete their borings in about three weeks, and turn to chrysalids at the extremity, from which most of the beetles emerge in about a fortnight more, or gradually for some weeks, eating their way out through the thin remains of the bark covering their chrysalis cells. The beetles are about the sixth of an inch long, dark brown mottled with ashy, and with clubbed horns.

suggested, and also that this should be in the month of June,—that is after the beetle has laid her eggs, and before the young brood from them have developed to the perfect stage. Also, where the standing trees which are attacked are young, it is advised that careful hands should go over them, and (during the month of March, and guided by the shot-like holes in the bark) pare off the outer bark down to the depth at which the beetles are hibernating in tunnels. This remedy would cause little injury to the trees, but is not advised earlier than March, as the Ash is liable to the injury of the bark rending through frost, known as frost-bite.

ASPARAGUS.

Asparagus Beetle. *Crioceris Asparagi*, Linn.



CRIOCERIS ASPARAGI.

Asparagus Beetle, larva, and eggs (all magnified); lines show natural length of eggs and beetle.

Specimens of the Asparagus Beetle, together with its eggs and grubs, were forwarded on the 14th of June by Mr. R. Cooke, from Detling, Maidstone, with observations of the damage caused by the grub eating off the outer rind of the Asparagus.

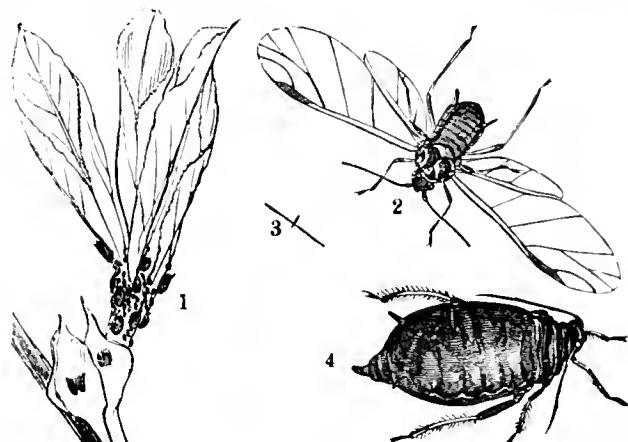
These beetles are about a quarter of an inch long, and of a blue-black or greenish colour, with ochreous coloured patches on the wing-cases. They lay dark-coloured spindle-shaped eggs on the shoots or unopened flower-buds of the Asparagus, these eggs being fastened by one end, sometimes in rows, but sometimes the egg may be found fixed by its end to another similarly fixed to a shoot. The grubs are of an olive or slaty colour, and do most mischief by feeding on the leaves and shoots during the fortnight's time that their period of feeding lasts. They then go down into the ground, where they change to chrysalids, from which the beetles come up in about two

or three weeks, and there is a succession of broods, so that the insect may be found in all its stages throughout the summer.

The grubs hold on to the stems so tightly by the ends of their tails that it is a hard matter to pick them off; but if the Asparagus is syringed with warm water (or cold may be used), and the plants then smartly shaken, many of the grubs will fall to the ground. A good sprinkling of soot or of quick-lime, thrown down on them immediately, will prevent them, or most of them, returning to the plants. Dipping the shoots in a mixture of a quarter of a pound of flour of sulphur, a quarter of a pound of soot, and half a pound of soft-soap, all well stirred together in a pail of water, has been found useful.

B E A N .

Bean Aphis ; Black Dolphin ; Collier. *Aphis rumicis*, Fab.



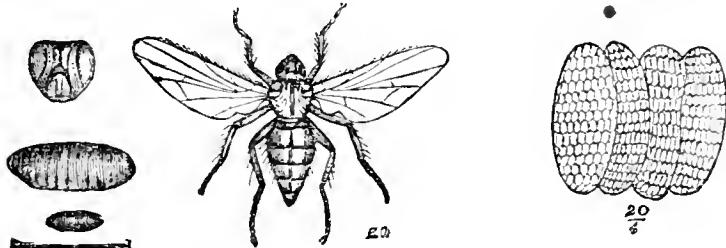
Bean Aphis. 1, Bean-shoot with Aphides ; 2, male, magnified ; 3, natural size ; 4, wingless female, magnified.

The only note of the presence of Aphides, or Collier, occurring on Beans to a destructive extent during the summer, was forwarded by Mr. Harley Kough, of Church Stretton, who mentioned, on July 8th, that the Beans in his garden were greatly blighted. No better remedy appears to be known at present than cutting off as much of the top of the Bean plant as is infested directly the Colliers are seen upon it, taking care, at the same time, that the pieces which are cut off shall be removed and destroyed, so that the Colliers shall not be able to get back again from them to the growing Bean crop.

At Detling, Maidstone, it is noted by Mr. R. Cooke that attack of Bean Aphis was kept fairly in check by picking off and burning the tips of the shoots affected ; and at Park Farm, near Kingsnorth, Kent, the field crops were generally clean.

BEET.

Beet, or Mangold Fly. *Anthomyia betæ*, Curtis.



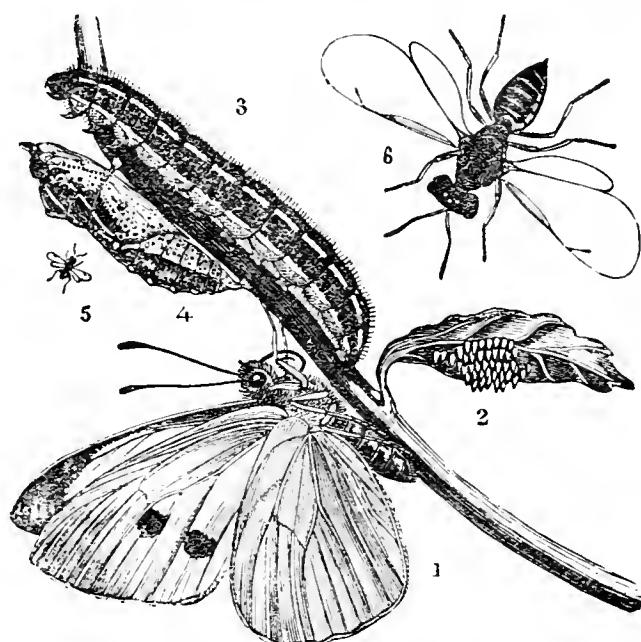
BEET, OR MANGOLD FLY.

Beet Fly (female), magnified; line showing spread of wing, natural size.
Head, mag. Pupa, nat. size and mag. Eggs (after Farsky), mag.

The only observation forwarded during the season of serious attack from the Beet Fly, was an outbreak on about seven acres at Portnard, Pallasgreen, Ireland, mentioned by Mr. R. E. Lloyd as occurring towards the latter part of June. No information has been contributed as to remedies for attack beyond those already named (see Report on Injurious Insects for 1880), which turn mainly on supporting the crop by stimulating dressings whilst it continues, and also (whilst the attacked plants are small) drawing and destroying them.

CABBAGE.

Large Cabbage White Butterfly. *Pieris Brassicæ*, Latr.

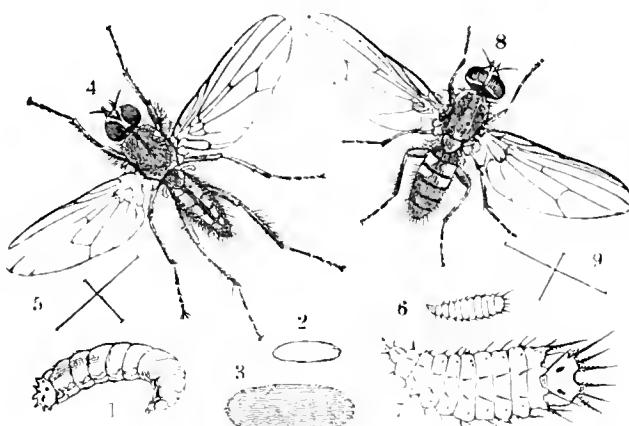


PIERIS BRASSICÆ.

1, Female Butterfly; 2, eggs; 3, caterpillar; 4, chrysalis; 5 and 6, parasite Ichneumon fly, *Pteromalus Brassicæ*, nat. size and mag.

During the autumn a good many caterpillars of the Large Cabbage Butterfly appeared on a bed of Broccoli in my garden near Isleworth, which I found were most conveniently got rid of by hand-picking, otherwise these caterpillars are not mentioned as having been injurious during the past season.

Cabbage-root Fly. *Anthomyia floralis*, Fallen.



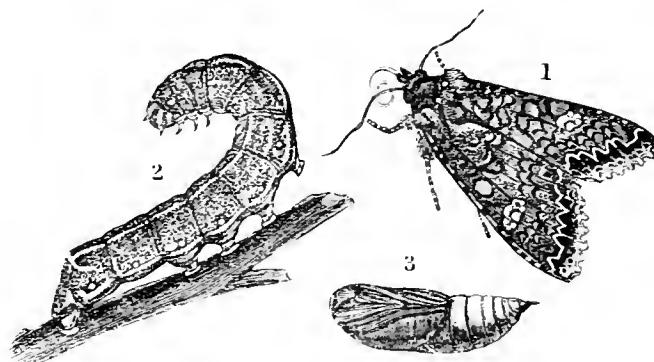
CABBAGE-ROOT FLY.

1, Larva of *Anthomyia Brassicæ*; 2 and 3, pupæ, nat. size and mag.; 4, *A. radicum*, mag.; 5, nat. size; 6-9, *A. tuberosa*, larva and fly, mag. and nat. size.

During 1881 much damage was done by Cabbage maggot in Scotland, and as several of the different kinds of maggots infesting Cabbage roots are so much alike that it is scarcely if at all possible to tell the difference between them, and the flies which they develop into have also a strong resemblance to each other, a doubt arose how many kinds might be at work.

Early in the past summer, therefore, Mr. Malcolm Dunn forwarded specimens of maggots from Cauliflower roots to Mr. R. H. Meade, Bradford, who after rearing them to development, favoured me with the information that they were the *Anthomyia floralis* of Fallen (a small fly variously marked with black and gray), of which the male closely resembles the figure given above at 4 of *A. radicum*.

This kind (*A. floralis*), known in Germany as the Radish Fly, is recorded as having been found in the maggot stage in the roots of the common garden Radish, a circumstance which may explain attack occurring to Cabbage roots on ground where Radishes have been extensively grown. It was also reared by Mr. Meade this year from maggots found in earth round partly-decayed Clover roots. Remedies found serviceable, in cases where it attacks Cabbage, were mentioned in the Report for 1881, pp. 8—10.

Cabbage Moth. *Mamestra Brassicæ*, Linn.

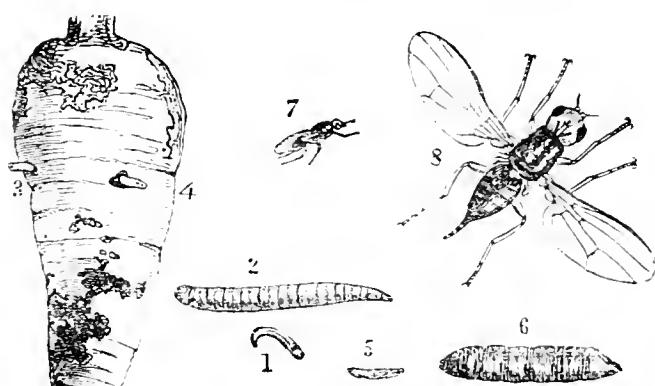
MAMESTRA BRASSICÆ, Linn.

1, Moth; 2, caterpillar; 3, chrysalis.

Mr. Hart, writing from Park Farm, Kingsnorth, mentions the caterpillars of this moth as having caused some harm to hearted Cabbage, but that they were not abundant.

In my own garden there was a little injury also to hearted Cabbage, but this was less to Cabbage in rows amongst other plants (as between Celery trenches) than where the Cabbage was in a bed.

Clearing off such of the lower leaves of the Cabbage as lay on the ground appeared a very serviceable plan. Many of these leaves are partly decayed and have ceased to be of much value to the plant, and they not only afford a convenient shelter by day to caterpillars, slugs, or other night-feeding plant vermin, but help to give the easiest possible access up to the food.

C A R R O T .**Carrot Fly.** *Psila rosæ*, Fab.

1, 2, and 3, Larvæ, nat. size and mag.; 4 infested Carrot; 5 and 6, pupæ; 7 and 8, Carrot Fly, nat. size and mag.

Mr. James Kay, Bute Estates, Rothesay, mentions that in early spring he sowed a bed of Carrots, which appeared to grow all right until about the middle of June, when there were evident signs of the Carrots in the centre of the bed being affected by wireworm, these making such rapid progress that the whole crop seemed certain to be destroyed. No further attention was paid until about a fortnight later, then, on looking again with a view at least to kill the wire-worms, salt was hand-sprinkled over the infested part, and watered with paraffin water to make the salt effective at once. This application, made of course with the knowledge that it was strong enough to kill all it came in contact with, proved very successful. The wire-worm attack seems to have been stamped out, as the portions at the end of the bed which were uninjected previous to the application have remained fresh and green up to the date of writing.

Mr. W. Ward, writing from the Gardens, Stoke-Edith Park, Hereford, advises—In preparing ground for Carrots, manure the ground well with good rotten manure; mix at the rate of two bushels of quick-lime to one bushel of salt; incorporate well together, and spread this thickly on the soil or manure, then, in digging, mix these ingredients well with the soil.

At the time of sowing the Carrot seed cover the surface well with quick-lime, draw drills in which to sow the seed, tread soil in upon the seed, and rake the whole over with a wooden-toothed rake, and if the soil is light roll well in addition. This applies equally well to Turnips, and if more lime and salt were used in the preparation of the ground for the Turnip crop, I think the returns would be adequate to the outlay. Of course, in field culture it becomes a costly affair.

Mr. Grierson mentions that at Torloisk, Isle of Mull, the fly did little or no damage to the Carrots. He prepared the ground as he mentioned, p. 21, Report 1880 (that is, had it trenched about two feet deep, and a good layer of farm manure placed at the bottom of the trench in the previous winter. In the spring, after the ground had been prepared in the usual way, deep holes were made about eight inches apart, and filled with a compost of good soil, stimulating manure, soot, &c., and a few seeds placed in each hole)—and the Carrots have turned out an excellent crop.

At Kingsnorth, Kent, Mr. Hart mentions that he had the worst attack of the Carrot grub that he ever experienced on his garden Carrots, but his field crop was quite healthy.

Mr. Freestone, writing from Manor Park, Forest Gate, mentions his Carrots were affected in a manner he had not before observed. The foliage turned yellow in June and July, and when pulled slightly the plants came up easily, the points being black and rotten, as if they had been attacked by an insect. This was probably from attack of Carrot-grub.

C H E R R Y.

Cherry Aphis. ? *Myzus Cerasi.*

Mr. Hart notes that two of his Cherry trees near Kingsnorth, Kent, were smothered as usual with the Black Cherry Aphis, or Dolphin; and although the trees were cleansed with suds, paraffin and water, or pure water, the fruit was of an inferior quality. Similar trees facing north-west on the opposite side of the house are never attacked, and the fruit is very fine.*

C L O V E R.

Clover-root Weevil. *Sitona puncticollis*, Steph.

On the 6th of April I received an enquiry from Mr. R. W. Christy, of Boynton Hall, near Chelmsford, relatively to a small grub which destroyed the roots of Red Clover. He mentioned that under every one of about fifty diseased plants, which he had examined on the 23rd of March, he found two, or three, or sometimes more, small white grubs. Most of these were to be found at or near the tap-root of the Clover, and some at the extremity of the smaller roots which showed injury from their gnawings; in some cases large holes had been eaten, and in all cases the part thus injured had turned black.

On examination of a great many more Clover plants on the 10th of April, a still larger number of grubs were to be found under them; in some cases as many as five or six under one plant. In no case was a diseased plant to be found without a grub, but no grubs were to be found between the rows of Clover; and where the plants had died or withered no grubs or chrysalids were to be found. The Clover land in question was a large field of twenty-four acres, twelve of which were in Wheat and twelve Barley last year (1881); and it was observed that the grubs were much more plentiful on the solid Wheat land than on the looser Barley land.

These grubs or larvae, when full grown, were about a quarter of an inch long, legless, and much wrinkled; of a whitish colour, with ochre-coloured head, and dark brown jaws. Some of the specimens

* Plum trees were much injured, from their leafage being destroyed by the gale of April 29th; and when the fresh leaves were thrown out these were severely attacked by Aphides. Owing to the manner in which this attack causes the leaves to curl, it is very difficult to bring any application to bear on the insects within.

forwarded on the 10th of April ceased feeding, and formed hollow chambers in the earth by the 8th of May ; and at the end of May and beginning of June some of them were turning to chrysalids. By the 26th of June they were numerous in the ground in the Clover field at Boynton Hall, most of the grubs or maggots having apparently changed by that time. The weevils from the earliest formed chrysalids began to appear about the 20th of June ; the changes to the chrysalis state happened rather later in the field than to the protected specimens.

These Clover-root weevils much resemble the common Pea weevil, excepting in being rather larger, and having a few whitish spots on each side of the central light line, which runs along the body from the head to the wing-cases. (See fig., under heading Pea Weevil.)

It has long been known that weevils of one or more species of *Sitones* frequented Clover, and maggots (sometimes known as "white maggots") have been known to be destructive to Clover-roots, but as far as I am aware their history had not been made out until Mr. Christy noticed them at their destructive work and secured specimens.

With regard to damage, five acres of Blue Peas had to be ploughed up entirely from this cause, and the other part of the field which was attacked was a very bad piece ; the weevils attacked them as soon as they appeared above ground, and kept at them till they were cut. Several farmers were obliged to plough up their Clover leys after the first cutting, the plant being destroyed by weevil maggots. The observer's own Clover recovered after the maggots turned to the complete state as weevils about the beginning of June.

With regard to habits later in the year, Mr. Christy mentions the great numbers of these weevils to be seen about. Every leguminous plant seemed to be gnawed and notched by them, especially in the neighbourhood of Peas and Beans,—"probably when the Beans were cut they flew to the Clover leys, as I have seen great quantities on the wing in a warm day in August. At harvest-time the weevils were abundant on the young Clovers, the platforms of the 'reapers' being literally covered by them, and they could be swept out of the carts when carrying Beans and Peas by thousands."

On the 21st of October it is noted,—"The roots of Clover now have no larvae near them ; I have examined a great many." About five weeks later, however, they were again at work—on the 28th of November the larvae were mentioned as feeding in a Clover field at the present time. Looking at this fact, together with the observation made by Mr. Christy in the spring, that the Clover in the attacked field was dying, *excepting on the spots where the thraves of wheat had stood for a month or more in harvest-time of the previous autumn*, it all appears to point to the quantities of weevils seen in harvest-time then laying

their eggs amongst the Clover, the maggots from which soon appear; but further observation has yet to show whether the greater part of them live as maggots through the winter, or whether they all turn before winter to the complete weevil. This autumn egg-laying appears to be the point to be specially prevented, *if possible*. Where the weevils are in the great quantities reported this year by Mr. Christy, last year by Mr. Hart, sweeping up these legions into buckets of mud or anything that would keep them from flying away, and then destroying them, would do something; but the great thing would be to put some dressing—such as gas-lime, or other application offensive to the weevil, and not in quantity or quality strong enough to hurt the plant—on the Clover.

As far as we see from habits of some other crop-pests, what we need is not so very particularly an application which will keep the insect from going down into the ground to lay its eggs when it comes (though this is highly desirable), but something which will *prevent the crop attracting it to come*. There is a power, answering to our power of smell, in many kinds of insects which draws them in bodies to where their food is, as we see in Turnip Fly going up the wind to a Turnip field; in Gooseberry Sawfly caterpillars crossing a road from one market garden to another; and if some substance is applied, either with a peculiar smell, as above mentioned, or soot, guano, nitrate of soda, or any chemical or other application foreign to what is in any way likely to attract the beetle to lay eggs, and which is also beneficial in restoring “Clover-sick” land, it would be likely to be of great service; and practical observations on this point would be highly acceptable for publication.

More than one kind of these weevils (scientifically *Sitones*) feed on Clover. Curtis mentions the *S. lineatus* also being destructive to it; and the Rev. W. Clutterbuck, of Long Wittenham Vicarage, an observer for many years, gives a note of the Pea Weevil, *S. lineatus*, having been observed to shelter itself in the top joint of the stubble of Barley, Oats, or Wheat. He says, “We traced the sometimes total loss of the crop of *Trifolium* to this source, inasmuch as we found the insects in the top joint of the stubble, among which we usually drilled the *Trifolium incarnatum* without ploughing. We lightly skimmed the stubble, and so deprived the weevil of its habitat and refuge; and we believe we abated the evil.”

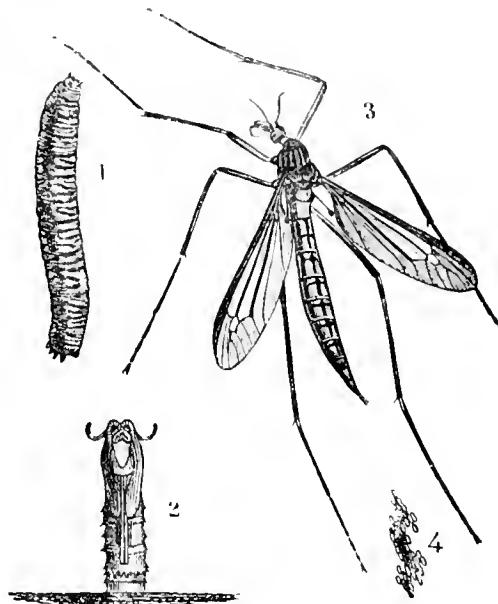
Mr. D. Turvill, of West Worldham, Hants, mentions an instance reported to him, in which Peas, having been sown after Clover, were so completely eaten off that the crop was worthless.

For further observations on Clover, Pea and Bean Weevils (*Sitones* of different species), see “Pea Weevil.”

CORN AND GRASS.

Daddy Long-legs. *Tipula oleracea*, Linn.*

Spotted Crane Fly. *T. maculosa*, Linn.



1, Larva ; 2, pupa-case ; 3, fly ; 4, eggs.

On the 3rd of April Mr. John Hill forwarded specimens of Daddy Long-legs grubs of various ages from a field of Wheat on light sandy soil. This was sown on the 4th of February, after one year's Clover ley, and had been well limed before ploughing. The grubs were reported to be in thousands, and the ground to be perfectly alive with them. Information was also sent on the 17th of April, from the neighbourhood of Totnes, Devon, of a Barley field, sown about the beginning of March, being destroyed by the Daddy Long-legs grub. In this case the land was rather heavy, and on ley which had been out two or three years. The grubs were to be found in hundreds all over the field and began to eat from the centre. At the time of writing they had hardly left a blade, except a narrow strip less than a land yard wide, round about two-thirds of the field, which they evidently intended to finish.

On the 18th of April Mr. Fletcher, of Felhampton Court, Church-Stretton, wrote regarding great injury being caused to a bed of Strawberries planted in the previous autumn (on land from which a crop of early Potatoes had been taken) by means of a grub which turned out to be one of the smaller kinds of Daddy Long-legs,

* The Leather-jacket Grub being mainly injurious to Corn and Grass crops, the reports of injury from it are placed under the above heading, to which the reader is referred from the headings of special crops attacked.

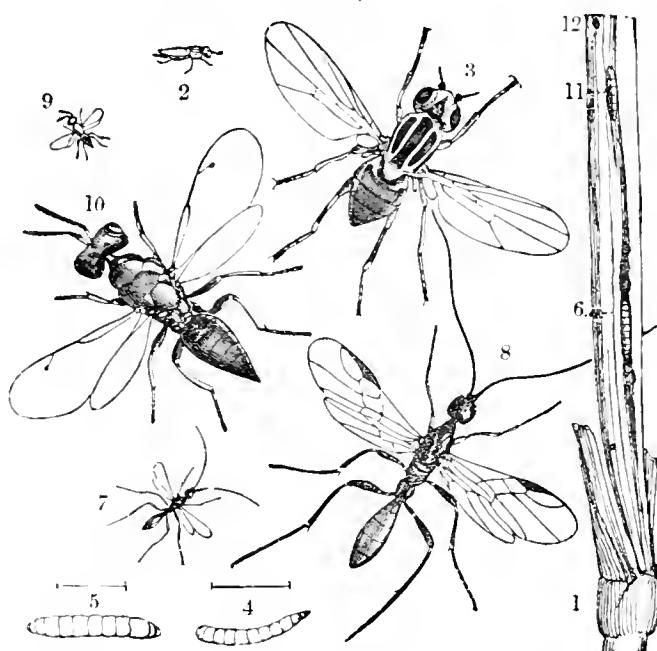
--apparently *Tipula maculosa*. The plants had been top-dressed in the autumn with nearly rotten horse-manure, and at the time of writing were coming through nicely, but about twenty per cent. failed, going off after they had first started. The grub was to be found with its head well into the heart of the young plant, and the leaves all bitten through at the bud.

On remedies being suggested, operations were at once set on foot, by scooping away the soil from every plant; and it was found there were often as many as four or five grubs of different size around a single plant, at work or about to commence. About half of the plants had no grubs at the root, and some that were nearly or quite destroyed had only one.

The hand-picking proved quite successful and did not require repeating, as after the first clearing of the grubs not another plant was lost.

Mr. George Brown, writing from Watten Mains, Caithness, mentions that the Daddy Longlegs grubs were plentiful in the soil, but owing to the rapid start and growth of the corn crop they caused no damage.

“Haulm Fly”; Ribbon-footed Corn Fly. *Chlorops tenuiopus*,
Curtis.



CHLOROPS TENIOPUS.

2-6, Larva, pupa, and fly of *Chlorops tenuiopus*, nat. size and magnified. Parasite flies,—7 and 8, *Cælinius niger*: 2 and 10, *Pteromalus micans*, nat. size and magnified; 1, 11 and 12, infested Corn stem.

Mr. Hart gives the following note regarding the presence of this corn-stalk maggot in a part of one of his fields at Kingsnorth:—

"I had some Oats slightly injured by this attack, on a piece of ground that has suffered from it more or less every time I have attempted to grow Oats (or Barley) there. The last time Oats were sown the crop was entirely destroyed. Now a narrow strip across the field was attacked just about where I grew Potatoes last year, but there being abundant moisture, the plant survived and produced a fair crop, though it was somewhat later than the rest of the field. It is singular that a narrow strip should be attacked in this way and the rest remain clear."

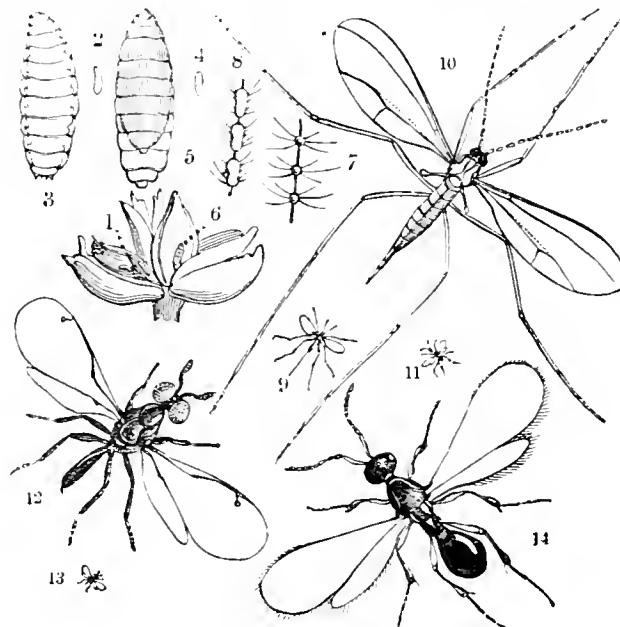
This fly appears to be without an English name of a serviceable kind; I have therefore ventured to suggest above the literal translation of one of its common German names—the "Haulm Fly." This does not confuse it with any other of our crop flies, and is very descriptive, as the presence of the attack is known by the distorted state of the *haulm*, the stem being commonly stunted or swollen at the joint, with the ear in the case of Barley (which the fly particularly frequents) even at full growth still sheathed in the leaves, within which the stem, below the ear, is furrowed down to the first knot by the grub. The attack of this fly has been noticed in wet patches, as on one or two acres of the wettest part of a field, or along the water furrows. I have also seen the injured haulm on wet, poor land, and also near grassy headlands. The following notes, from German observations, give a reason for the appearance near wild grass land, and hint as to treatment:—

It is observed—in answer to the question, Where do the flies come from in the spring?—that the autumn brood have been found to lay their eggs on the late-sown Corn or on wild Grass. The maggot, which soon hatches, pierces into the inside of the plant down to the neck of the root, and there it winters; the attack at this time is not noticeable. Next spring, when the young plant starts, the part that is not attacked grows on straight and tall, hiding the diseased growth, which is something like that of the diseased summer haulm,—that is, with wide leaves and a thickened shoot,—but from the different state of the plant is not precisely like what is observable in the grown crop. If this growth is cut open, the maggot will probably be found within. Commonly the diseased leafage (it is stated) dies, whilst the maggot within goes through its changes and comes out as the perfect "Haulm Fly" during March and April, and soon begins the egg depositing and producing summer attack.—From observations by Professors Nowicki and Konopka, quoted in 'Prak Inseeten Kunde,' Dr. E. L. Taschenburg, Part IV., pp. 148, 149.

The remedies that suggest themselves from the above notes and our own observations appear to be, clearing away wild grasses, taking measures to prevent the soil being sodden or poor, and as the

wintering of the grub in the young Corn appears to do little harm, to prefer winter-sown corn to sowing in spring, when the Haulm Flies, hatched out of their winter quarter, are ready to lay, and cause in some cases (notably in 1841 and 1846) much injury to the summer crop.

Wheat Midge ; Red Maggot. *Cecidomyia tritici*, Kirby.



CECIDOMYIA TRITICI.

1, Infested floret; 2-6 larva and cased larva (pupa?) nat. size and magnified; 7-8, joints of antennæ, magnified: 9 and 10, *C. tritici*, nat. size and magnified. Parasite flies,—11 and 14, *Platygaster tipulae*; 12 and 13, *Macroglenes penetrans*, nat. size and magnified.

At Park Farm, Kingsnorth, Mr. Hart mentions that the Wheat Midge was not nearly so abundant as it has been for several years past, but still too plentiful in White Wheat; and he mentions that he still takes the precaution *to burn the dust* that falls beneath the threshing machine, in which may be found the greater part of the Red Maggots which the crop contains.

Mr. Russell Swanwick notes regarding the Wheat Midge, that it did somewhat less damage than of late years at the Royal Ag. College Farm, Cirencester, owing to its appearing a fortnight later than usual in comparison with the flowering time of the Wheat, and hence allowing the grains to become formed before the grub could feed on the sap.

Even in these improved circumstances the damage cannot be put at less than 15 to 18 per cent., or over a sack per acre on 70 acres; a loss therefore of £70.

In previous years, from and including the summer of 1873, when first noticed, the damaged florets in which the grain was entirely wanting have been from 30 to 40 per cent., entailing a loss of about three sacks per acre, or roughly £4 ; or as nearly as possible a loss on the Wheat of half a crop. It is remarked,—“ My neighbours would not at first credit my estimate of the damage, but on more careful examination they agree with me in its extent. There is no doubt that this neighbourhood has suffered more than most of late years, for (nowhere that I have been) have I noticed so much red and yellow chaff scale in the husk.”

Prof. Allen Harker notices the Wheat Midge as being out in myriads egg-laying on the Wheat, at the Farm, Royal Ag. College, Cirencester, in the evening, at the beginning of July ; and this precise date, together with Mr. Swanwick’s observations of the late appearance of the Midge relatively to date of flowering enabling the grain to be so far formed as not to be suitable to the maggot, is of much interest, as confirming what has been remarked both here and in American and Canadian husbandry. These show that where (by management of date of sowing on the other side of the Atlantic, and in this country undesignedly through influence of weather) the appearance of the Wheat Midge and that of the Wheat flower differ in date, we have much benefit. If, as above, the embryo Wheat is too much formed to be serviceable to the just-hatched maggot, the creature starves ; if, on the other hand, the Wheat blossom instead of the Midge is late, we benefit just in proportion to the numbers that perished before our crop was ready for them to lay their eggs in.

Wheat-bulb Fly. *Hylemia coarctata*, Fallen.*

Early in June of 1881 a communication was made by Mr. W. Creese, of Teddington, regarding loss which he had suffered for many years in his Wheat crop, by means of a maggot feeding in the young plant.

The attack was observable early in March, or in mild seasons about the middle of February, at which time the maggot was so small as to be hardly perceptible. Its place of feeding was just at the base of the stem, where it remained for a short time and then moved off to another shoot, and by the beginning of June the maggots had usually disappeared.

* Notes on this subject were given in the Report on Injurious Insects for 1881, but we were not able then to make out which of the Fly maggots present did the damage ; part of the life-history is therefore repeated.

The specimens of young Wheat plants forwarded were for the most part so much injured by the gnawing of the maggot that they were consequently decaying, and, though the severe nature of the attack was plain, there was difficulty in making out the kind of fly which caused it, for very few maggots or chrysalids then remained. Of these the only one that developed to an injurious insect proved to be either of the *Oscinis frit*, the Frit Fly itself, or of a nearly allied species; but whether it was the above or *O. vastator* (which is considered by Taschenberg to be the spring form of *O. frit*, feeding in the Wheat bulb, whilst the autumn brood feeds in the ear), it was of interest as showing the presence of such an injurious fly. Still such a small quantity of it was present that it was by no means certainly the cause of the attack, and further specimens were requested. Young Wheat plants were accordingly forwarded by Mr. Creese, at the end of March of the present year (1882), with maggots then feeding inside the stalk, just above the bulb; and I am permitted to state, on the authority of Mr. R. H. Meade, who watched the progress of these larvæ up to their development on May 27th, that they are the maggots of the two-winged fly, known scientifically as *Hylemyia coarctata* (of Fallen).

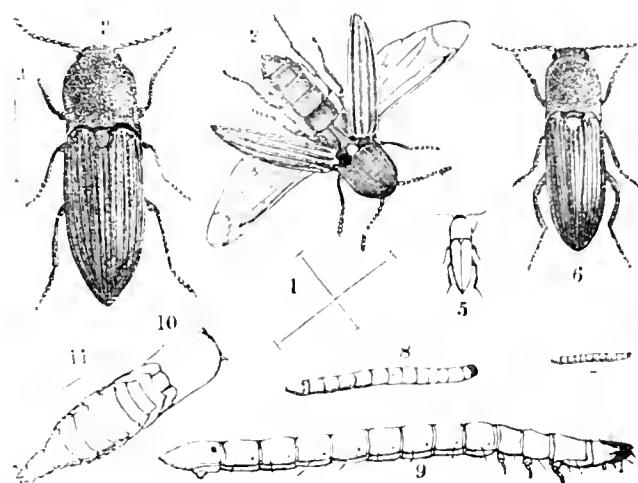
This is a small fly, not unlike the Onion Fly in general appearance. The females are pale ash-grey; the males have body between the wings (*thorax*) grey and lighter at the sides, with a faint stripe along the centre, and the abdomen, which is long, narrow and flat, ash-colour also, with a faint line along the back.*

The maggots or larvæ are whitish and legless, much like those of the common Blue-bottle Fly in appearance, and when full grown are upwards of a quarter of an inch in length; the pupæ or fly-cases are chestnut-brown.

With regard to habits and amount of injury, it is mentioned by Mr. Creece that the Wheat-bulb maggot is entirely absent in some seasons, but is very destructive in about three years out of four; that it attacks plant on land which has been fallowed in the previous summer, but does not ever appear on land ploughed for the first time in the autumn; also that it "always leaves a belt of five or six yards near the hedge untouched." The damage is sometimes so complete as not "to leave a healthy plant in a yard," and in 1881 the destruction by Wheat grubs was at the rate of 15 bushels per acre in 50 acres of fallow Wheat.

* For full description see "List of British *Anthomyidae*, 16. *Hylemyia*," by R. H. Meade, 'Entomologists' Monthly Magazine,' 1882, p. 269.

Wireworm and Click Beetle. *Elater (Agriotes) lineatus*, Curtis :
Elater (Agriotes) obscurus, Curtis.



AGRIOTES LINEATUS.

1 and 2, *Elater lineatus* : 3 and 4, *E. obscurus* ; 5 and 6, *E. sputator*, nat. size and magnified ; 7, larva of *E. sputator* ; 8 and 9 larva (wireworm) of *E. lineatus*, nat. size and magnified ; 10, pupa (lines show nat. length).

The following report on Wireworm, from notes contributed in reply to a circular issued by the Council of the Royal Agricultural Society, requesting information as to the habits of Wireworms and methods of prevention of their ravages, was compiled by myself, as Consulting Entomologist of the Society, and published in their Journal for 1883, vol. xix., part 1, and is now reprinted by permission of the Council.

For convenience of reference the communications received have been divided into paragraphs according to the subjects to which they mainly refer, and classed under special headings, the name and locality of the contributor being in each case appended to the information furnished. The series is thus arranged so as to run on continuously from the commencement of remedial measures (in the breaking up of pastures or leys), by which egg-laying may be prevented or the Wireworm killed, to the various methods of treatment of soil, or kinds of crops calculated to prevent or forestall attack, and further notes of various kinds of manures and applications which have been found to check attack when present.

It will be observed that two of the points mainly brought forward are, the importance of compressing the ground (by methods varying according to the nature of the soil and condition of the crop), so that the Wireworms may not have free passage in the land ; and also of maintaining such a vigorous growth as may carry the plant over the injury caused by an average attack.

The past season having been generally favourable to plant growth, it has turned out that though Wireworms began to run early in the

season, yet that the crops have suffered less than was threatened, and notes of serious damage have only been returned from a few districts. Therefore, injury not being prevalent, few estimates have been given : the following communications, however, give some idea of the power of the Wireworm when present in the crops.

ESTIMATES AND NOTES OF AMOUNT OF INJURY.

The extent of injury and money loss from Wireworm is difficult to assess, but on my farm of 1000 acres (Old Alresford, Hampshire), I do not think I shall be far wrong if I value the loss from Wireworm, on 350 acres of Corn, in an average of seasons, at not less than £2 per acre, or £700 per annum. There is also much damage to the root crops, causing further loss from the poorer condition of the crops, owing to the less time the sheep are on the land. I am sure the loss on most Hampshire and South Wilts farms is quite equal to the rent.

My chief experience of losses caused by Wireworm was whilst farming in the parish of Old Alresford, Hampshire, the damage done in this county (Gloucestershire, neighbourhood of Cirencester) being nothing to compare to that on the light chalky soils of the southern counties. Sainfoin being one of the best crops for such soils, together with old leys, a large proportion of the land is taken up with them, and being the breeding-places of the Wireworms for years together, naturally, on breaking them up the succeeding crops suffer much.—(T. R. Hulbert, North Cerney, Cirencester.)

Concerning damage from Wireworm on a field of 15 acres, the first crop injured was of Turnips, which were worth at the least £6 per acre ; and half the crop was destroyed by the Wireworm, which would make the loss £45, exclusive of labour. Last year (1881), it had Wheat grown upon it which ought to have been 10 bags to the acre (72 lbs. to the bushel) ; instead it was only 2 bags ; so consider the loss to be 8 bags at £1 1s. per bag, which would be £126.

The consuming price of a ton of straw lost per acre would be about £1, or loss on this item on 15 acres, £15.

Total during two years would thus amount to—

Loss on Turnips	£45
,, Wheat	£126
,, Straw ,.	£15
	—
Total	£186

(J. Heatley, Passingham.)

I have a 9-acre field of light, sound, gravelly soil, rich and good, which is very full of Wireworms. The injury done is very serious, being about 5 bushels per acre in the patches where it is taken.—(J. Prince, Foston, Derby.)

In some fields Wireworms often spoil half the crop of Wheat.—(G. Burgiss, The Farm, Strutherglen Park, Petworth.)

We have suffered much from Wireworm on the chalk lands during the last two or three years, but not as much during the present one.

On the clay lands we have not suffered to the same extent as upon the chalk, except in cases where we departed from the four-course rotation and sowed Wheat after a two years' ley. I attribute this partly to their having been in Clover for two years, and partly that being undrained we have to ridge up the field in small lands, which prevents the roller taking proper effect.—(A. H. Bowles, Clandon, Guildford.)

Wireworms have not troubled us for several years past, but previously they were a source of great injury in loss of Oat crops, and Turnip crops. Probable money loss no one can tell accurately.—(J. Forrester, for Right Hon. Viscount Portman, Bryanston, Blandford.)

Injuries are mainly confined to the crops on light, porous soils, except very sharp sands. On land subject to periodical attacks of this pest, my estimate of the average amount of injury is about 1-10th of the crop.—(F. Beard, Horton, Canterbury.)

The Wireworm this year was much better than last. In dry unkindly springs under our chalk hills, the Lent Corn, Oats and Barley suffer much from it.—(R. Cooke, Detling, Maidstone.)

Loss this year on one farm, a quarter of the crop; on another, from a quarter to a half; on another, loss estimated as usually a quarter, but sometimes half the crop.—(per J. H. White, Weybread.)

The Wireworm has this season been a great pest in the Fens, and also on high lands.—(C. Caswell, Peterborough.)

On one of the farms which I occupy, I lost, when first I took it, an entire crop of Wheat—money loss, rent, rates and taxes on the field, also seed and labour of putting in.—(C. R. Colville, Burton-on-Trent.)

SCOTLAND.—Wireworms have done great damage in this district this season. Some fields of grain were ploughed down last month (May) and resown, so that there will not be such a great loss; but there are many more in which the Wireworms have not left half a crop, and the loss in consequence must be 50 per cent.—(M. Dunn, Dalkeith.)

I have 17 acres of Barley injured this season by Wireworms; taking the average loss over the field at 2 quarters per acre, this is £3 per acre, present market price.—(D. Husband, Struthers, Cupar, Fife.)

Wireworms have (as usual) been rather numerous, particularly amongst lea Oats, and have kept back the crop from ripening early. Consequently, where Wireworm have abounded, a good many farmers have not yet (Oct. 6) got all their crops into the stackyard, and they deteriorate by long exposure.—(T. Dow, West Idvies, Forfar.)

In the Isle of Man, though the Wireworm attack is for the most part less than usual, yet estimates of amount of damage at various localities run as follows :—

1 boll to the acre on Oats; about 2 bolls* per acre, or about a quarter of the crop of Wheat. Half a crop of Turnips; 6 tons of Turnips where 15 tons were expected; $1\frac{1}{2}$ tons of Turnips, 1-8th the expected crop lost per acre; and a loss of £10 per acre on Carrots in a previous season is noted, per P. M. C. Kermode, Ramsey.

If we look now merely at the amount of injury named in the foregoing estimates, beginning at the lowest direct loss stated, we find two instances of this being about an eighth of the crop; one of loss of two-fifths; two of a quarter; two of a quarter to half; and four mention a loss of half of the crop. Two entries give notes respectively of the entire loss of a field of Wheat, and of crops having been ploughed in. Of the others of the 17 returns which give definite amounts of loss, one is at a rate of 5 bushels, another of 2 quarters per acre. An average of loss near Canterbury places it at one-tenth of the crops; and another, giving the average of money loss on 350 acres of a 1000-acre farm in Hampshire, places it at £2 per acre, this last not including loss on roots or further loss consequent thereon.

This gives some slight idea of what the Wireworm can do in the way of injury per acre; and it should be remembered that when it has injured one crop its work is by no means done.† It lives on for

* A boll of Wheat in the Isle of Man is 4 bushels, at 64 lbs. to the bushel.

† Wireworms are the grubs or larvae of the small beetles commonly known as "Skip Jacks," "Snap" or "Click Beetles," from their habit of flying up in the air with a kind of snap or click, when laid on their backs, and thus regaining their natural position. Like other beetles, they pass through three stages (larva, pupa, and complete insect), but they differ from many kinds in the fact of continuing in the grub or larval state (that is as Wireworms) for many years; the pupal or chrysalis stage appears only to last in summer for a very short time, a fortnight or so. The change to this state takes place at a considerable depth in the earth, and many of the beetles come up from the pupae or chrysalids in July and August; but it is considered that some probably pass the winter in this condition and come up with the return of warm weather in the next season.

The Click Beetles are of many kinds, and are commonly from about a quarter to half an inch in length, and of a breadth of about a third of their length, and brownish in colour, with a pair of long horns and six legs—the Wireworms are commonly of a straw colour, and of the shape figured at page 22; when examined very carefully they will be seen to have six little legs like claws, one pair on each of the three rings nearest the head, and by having *six and no more than six legs* they may be easily distinguished from Daddy Longlegs grubs, which have none, and from Julius worms, millipedes, centipedes, &c. which have many, and which are often confused with the true Wireworm or grub of the Click Beetle. From the habits of the beetle and the locality where the young Wireworms are found, there appears to be little doubt that the eggs are laid either a little below the surface of the ground, near the food plants, or amongst the leafage just about the ground level.

many years, for five years so far as we know, feeding the whole time (excepting when it may go down deep for shelter in the winter) on almost any crops, and, failing them, on grass roots or what it can find.

Some parts of the country, as the Orkneys, and part of the Scottish Seaboard and Islands, appear to be little troubled with it, but it is widely spread, and one of our pests which is never totally absent; and looking at the acreage under crops which it particularly attacks, as Wheat, Barley, Oats, also Hops, Swedes and Turnips, Potatoes and Mangolds, amounting as stated in the Government Agricultural Returns for 1882, to 8,406,709 acres in England only, each farmer can see for himself the vast cost of entertaining such a guest. The following communications show methods by which its presence may be much diminished and injury from its ravages lessened, in cases where it cannot be wholly got rid of.

TREATMENT TO PREVENT EGG-LAYING TO DESTROY OR STARVE OUT WIREWORMS.

Observations concerning such treatment of pasture or Clover ley by close grazing, treading with sheep, dressing with lime, gas-lime, salt, and nitrate of soda, &c., as may best prevent the Click Beetles from laying eggs, or which may destroy such eggs or Wireworms as may be in the soil, before the land is broken up. Various methods of ploughing and consolidating the land: also of paring, burning, and cleaning out roots and rubbish, and of cropping and manuring suited to starve out or destroy the Wireworm and promote good growth of the next crop.

Feed down the land as bare as possible before ploughing it, and leave as few stumps of grass as possible or leaves to plough in. I believe a top-dressing of lime, or lime and salt to the land, after it is eaten down bare, and before it is ploughed, would also tend to check the Wireworm. After the land is ploughed, roll it down as tight as possible.—M. Locke Blake, near Ilminster.

In order in some degree to prevent mischief from this pest, it is well to consolidate the surface thoroughly, and to graze every bit of plant off all leys or pastures which it is desired to break up. For this purpose sheep and cattle should be fed with cake, corn, or other feeding stuffs, so that each inch of land shall be trodden and eaten bare. By this means the grub would be destroyed, or if it escaped being trodden to death it would find great difficulty in obtaining food, both through the scarcity of vegetation and the solidity of the surface soil.

A dressing of gas-lime on the surface and ploughed in, has a good effect on any of the worms which may have escaped the treading and starving.

On land suspected of containing this plague it is advisable to sow

the crop broadcast, in preference to sowing in drills, as the worm has been observed to follow the drill-mark with great regularity, and crops sown in drills have been found to suffer much more than those sown broadcast, the reason being the greater facility with which the grub finds a new plant when it has eaten the old one.—(Adam Lee, for The Right Hon. the Earl of Powis, Lydbury, North Shropshire.)

IRELAND.—We have no Clover leys here, but we have considerable trouble with Wireworms in old grass leys. I treat them as follows:—

If the lea is broken for Oats (our general crop), it is sure to be attacked more or less by Wireworm; I top-dress with 4 cwt. agricultural salt, 2 cwt. superphosphate, and sometimes 1 cwt. nitrate of soda. I have never found this to fail if applied in time. If the lea is broken in the autumn, to have green crops in the following year, I have the land worked as much as possible, and apply 8 tons hot lime to the statute acre; lime as hot as possible. I always sow the seed with a liberal dressing of farmyard dung, for such crops as Mangold, Turnip, Cabbage, Carrot and Parsnip, and I use the following dressing of artificial:—2 cwt. best bone meal, 1 cwt. nitrate of soda, and 3 cwt. common salt. I find the plants are soon forced up beyond the reach of damage.

On the old red sandstone formation I find lime absolutely necessary. I do not think 8 tons per acre is quite enough, and would use 10 tons if I could procure it quickly. That, and also common salt, will reduce most of these pests, and nitrate of soda in small quantities is most useful to force on almost any crop.—(Sir Richard Keene, Cappoquin, Waterford.)

Some years ago we suffered rather severely in this neighbourhood (Ballinacourte, Tipperary) from Wireworms, but since adopting the following system of top dressing previous to ploughing, the Wireworm has ceased to trouble us.

In preparing lea for Oats, I either top-dress the surface with lime or by sheep. When by lime, I prefer to draw the lime daily as it leaves the kiln, and put it down in heaps which I cover with earth. The heaps are small and placed conveniently for spreading. They are allowed to remain until the stones are pulverized, and then the lime is spread in the hot state over the surface. The effect of hot lime is to burn off the grass, and thus to destroy the food of the Wireworms; also when (as is well known), they come to the surface after freshet, they do not do well amongst the lime. Further, I am of opinion that this system of top-dressing has a good effect in destroying eggs from which Wireworms would have hatched. I use from 60 to 80 barrels of lime (measured before being pulverized) to the Irish acre.* Top-dressing by sheep-folding involves a system

* 100 Irish acres are equivalent to 162 English acres, consequently an Irish acre amounts to about one acre and three-fifths, English measurement.

of farming which I think could be extended with good results to Ireland.

My method is to pen such of the flock as are intended to be fattened during the winter upon the field. The size of the pen depends on the number of sheep and the extent of land to be top-dressed. I begin at one side of the field, and enclose as much ground only as will be thoroughly trodden in one week, removing the pen regularly once a week. The ploughs follow the moving of the sheep, so that the system does not retard the spring ploughing, as by the time the last of the sheep are sold off and the last move made of the pen, the field is within a day or two of being ploughed. The sheep are fed with Turnips, Oats and Hay.

This is a perfect method of manuring the field. The baird comes up strong and healthy, and very soon places itself beyond the ravages of the worm; but the secret of success is in doing the work thoroughly. I use 15 stone of seed per acre of Oats and 12 of Barley, employing a heavy roller as soon as the baird is above the surface.

I may add, that three years ago a field of 7 acres was, as an after-thought, ploughed without having undergone any system of top-dressing, and it was almost entirely destroyed by Wireworms. In fact, the produce in Oats from the entire field was only 1004 stone, when we calculated on 300 stone per acre.—(S. Sym Scott, Ballinacourte, Tipperary.

I have for the last 10 years here grown from 45 to 60 Irish acres of Turnips. My system of cultivating them is to plough deep in autumn, leave it exposed all the winter, until the proper time in spring for preparing for green crops, when I first harrow down the winter ploughing, then grub deep with three or four horses; again harrow and pick off any weeds. Grub again with a light grubber drawn by two horses, and harrow and roll if required, and this is generally all that is required. Before opening the drills I like to leave the ground that is prepared a few days in dry weather, before working, so as to draw a little moisture. A man with a pair of horses then opens the drills, others cart in the farm-yard dung, while another set of men and women spread the manure and sow the artificial manure, another man with a pair of horses closes the drills, and a man with a pony sows the Turnips and does odd work in the field.

I mix mould or ashes amongst the artificial manure and salt on dry soil before sowing it. The farmyard manure I get turned over if possible ten days or a fortnight before using it, and saturate it well with liquid manure, so as to have it in proper order; I also mix the Turnip-seed before sowing with flower of sulphur, which is a great preventive against the Turnip Flea or Fly. I never have, as yet, had to sow Turnips secondly, and we have always very heavy crops. I

often skim and clean stubble for Green crops, and plough in the farm-yard manure, which is a good plan in dry, hilly land, and saves much spring labour.—(William Stoddart, Steward for Lord Clermont, Clermont Park, Dundalk.)

I have been farming on gravel land on the four-course system, feeding off the roots by sheep on the land, and thereby treading it. As the growth of Clover as often as every fourth year encourages Wireworm, and the land is liable to become clover-sick, I have occasionally (when I had any cause for alarm) substituted Beans or Peas on about the worst half of the land for clover; the other half the same, next time. By this means, and by firming the land, and getting it into good condition by manure, the crop is better able to stand attack of the Wireworm.—(Richd. R. Ridder, Moreton on Lugg, Hereford.)

As a rule I always plant Oats or Dredge (the latter a mixture of Oats, Barley, and Peas), as I find the Peas fill up should the Wireworm thin the Oats too much. Care should (I think) be taken not to plough the ley-grounds too long before planting the Oats, &c. If the land gets too stale, *besides getting grassy*, experience tells me the crops suffer most; therefore I prefer not ploughing before the beginning of the New Year, for sowing in February. I also prefer sowing the corn broadcast on such ley ground, giving it as many as seven double turns with the harrows, and then rolling it. When drilled I fancy the Wireworm follows the drills more quickly.

The chief damage generally arises on the succeeding crop; after the Oats I generally sow Vetches, the next most certain crop, and least liable to the attacks of the Wireworm. After being fed off and the land planted with turnips the same season the roots generally fail; also the succeeding crop of barley is sure to be much injured.

The good old plan of *Paring* and *Burning* (Breast Ploughing) old Sainfoin and Seeds is the best way of preparing such land for any future crop, as it destroys many of the eggs, &c., but the increased cost and the scarceness of labour render the plan often impossible.—(T. R. Hulbert, North Cerney, Cirencester.)

* My opinion as to why the Wireworm attacks the second crop more than the first is, that it is in consequence of the mechanical state of the soil. When ploughed after old ley the furrows come up very tough, and after being well rolled and harrowed are so consolidated together that it is difficult for the Wireworm to make a fast progress. Also there is other food (old roots) plentifully at hand. This is proved, I think, by ploughing early, and thus letting the old roots rot too much before planting the crop; consequently the Wireworm at once

* The following note was received in reply to enquiry regarding presence of Wireworm sometimes occurring in larger amount on the second crop than on the one immediately succeeding broken up ley.—(Ed.)

begins the new crop for food, and thus it suffers more. With the second crop the land is generally properly cleaned ; the cleaner it is the more hollow and loose the land becomes, and the more the Wireworm attacks the crop, it being easy to get about, and nothing else to feed upon.—(T. R. Hulbert.)

We have had no Wireworm attack except on one piece of 5 acres of Barley, which was almost entirely spoilt, rolling heavily being of no avail. This was old meadow land, but perhaps it is worth notice that about one acre of this field, which was *burned* about five years ago, was not nearly so bad as the other four acres. Fires were made about 11 yards apart, and all the rubbish, weeds, roots, &c., burned, and the ashes spread about the land.—(R. W. Christy, Boynton Hall, near Chelmsford.)

Probably there is more Wireworm in Wheat after seeds than at any other time on the four-course system.

The special management is to plough the seeds up soon enough to give the turf time to rot ; by rollings to give a firm seed-bed, and by rolling *after* putting in the seed (where this is practicable) to compress the soil with a view to preventing the frost lifting the surface, and so injuring the young plant. The judicious use of fertilizers strengthens the plant, and generally enables it to resist alike the effects of frost and the ravages of the Wireworm.

On land where, after seeds have been grazed for two or three years, the ground has been ploughed for Wheat in August (giving time for the turf to rot), and a firm seed-bed has been secured by plentiful rolling, also some fertilizer such as Guano or Superphosphate sown at the time that the seed is drilled, we shall not find any unusual amount of Wireworm. If, on the contrary, it is ploughed later in the season, and the land treated only as in the case of one-year-old Clover, the poverty of the surface will be shown by the large proportion of dead plants which have “damped off,” whilst the remainder “slow growing” will show Wireworm active amongst them.

In ordinary cases—cultivating the land immediately after harvest, burning all Grass and other roots carefully, and so destroying the eggs of the Beetle—repeated ploughings, which enable the rooks to carry off a large percentage of the Wireworms, and a thorough pulverizing of the soil, which may expose them, appears to me to be the effectual way of dealing with the Wireworms, or larvae of the Click Beetle.—(Ralph Lowe, Sleaford, Lincolnshire.)

Wireworm is especially destructive after two years' seeds, more particularly when the land is sown with corn immediately after ploughing, and so little worked that considerable spaces are left between the unbroken furrows. Early ploughing Clover Ley in the autumn and rolling the Wheat or Oats in the spring has been very advantageous,

but we attribute this rather to the solidity of the land, which enables the roots to work better, than to the destruction of the Wireworm.

During autumn last year we used gas-lime on Clover Ley before ploughing up for Oats, and, whether from that or from some other cause, there was no perceptible injury to the following Oat crop.

On a farm which I formerly had in hand, but which I let some years ago, there were when first I began to occupy it a great number of Wireworms. These almost entirely disappeared in the course of a few years, and we attributed this fact to the more thorough cultivation and working of the land. My Bailiff suggests that the removal of weeds, especially "twitch," in which the Click Beetle may have laid its eggs, is perhaps the cause of this. It is certain that the Wireworm is fast disappearing from the farm I now occupy, and we have found no appreciable injury from it this year.—(Joseph Paget, Stuffynwood, Mansfield.)

Breaking up Clovers and Rye Grass is generally done early, so as to insure decomposition of the plant, thus giving full effect to firming of the land by pressing with iron ring rollers.

Treading with sheep where affected, rolling, and harrowing are the means generally adopted. The only manure used as a top-dressing is soot, which is a good remedy for Wireworm.—(H. Hayward, near Hereford.)

I have suffered most in the Wheat crops grown upon the Clover Leys, and the best treatment that I ever discovered was to plough shallow, and after the seed was drilled either roll well or tread with sheep to well consolidate the ground.

Another system I have adopted is to plough the Clover Ley early, and get a crop of Rape or Mustard, feed it off for sheep, and then plough again for Wheat. This method I have found a great preventive for Wireworms, but at the same time by the early ploughing some part of the summer feed is sacrificed.—(Richard Pullen, Slandeford, Wolverhampton.)

Wireworm are most plentiful on land that has lain long fallow, and from old pastures, or from Clover Ley.

The methods of prevention in treating Clover Ley are—judicious fallowing, and such a thorough burning of rubbish as will destroy the eggs and grubs. Heavy rolling and brush harrowing will destroy many of them.

Ploughing the surface two inches deep with a breast plough, the turf being burnt or allowed to die, is recommended.—(John Sutherland, Berridale, Caithness.)

This year I have a splendid crop of Oats on very old ley. I used an American Prairie Plough with revolving mould-board, which brings up the subsoil to the surface. This made the ground easily broken down, and almost covered the sods. I then sowed with fine Rape Meal and

Oats mixed in the hopper, and the crop promises to be earlier than any sown at the same time.—(Chas. Littleboy, Straffan, Kildare.)

The field now in work for Wheat after mowing Clover twice is ploughed deep, then is harrowed well, so as to make the land solid, and keep a good tilth for seed, lime at the rate of four tons per acre worked in with the large harrow, and sown as solid as possible. This produces me the best crop, as the action of the lime converts the turf into suitable soil for Wheat.—(J. Prince, Foston, Derby.)

In breaking old Sainfoin up I sow about 5 cwt. of salt to the acre before ploughing it, and let it lie and get quite stale before planting. If I find any Wireworm I well press it.—(Jas. Bulford, Fordley.)

Salt sown at the rate of about 8 cwt. per acre on grass land before ploughing for a crop is recommended as a preventive for Wireworm. Gas-lime at the rate of about fifteen tons per acre spread on turf or seeds before ploughing has been found a certain cure, and soot sown before ploughing or after sowing is a good preventive, and promotes growth, especially for Wheat.—(Per J. Craig, Shifnal, Salop.)

I believe the best method to get rid of the Wireworm from pastures is to apply a good coat of lime on the surface ; an effectual plan is to plough up any land subject to the Wireworm, and mix the lime in the soil, say, at the rate of six tons per acre, after which a crop of Turnips should be grown and eaten off the ground by sheep hurdled up in pens. I have never seen that course a failure.—(Owen Price, Nantyrhain Brecon.)

IMPORTANCE OF HEALTHY GROWTH, AND NOTES ON MANURES.

Importance of such treatment of the seed and preparation of the land as will ensure healthy germination and vigorous growth from the first, with mention of various artificial manures and applications serviceable for this purpose, and opinions of various observers as to farm-yard manure being attractive to Wireworms.

Wireworm infests pretty nearly all dry, light soils. Its ravages are most fatal where the surface of the land is deficient in plant food; or where the seed used has been weakened from any cause; where the seed has been deposited too deep, or the sowing has been out of proper season, and the plants have to a considerable extent damped off.

In the case of Seed Oats that have been slightly heated in the stack and make no proper progress, the Wireworm will be found to work at its pleasure amongst them; or, again, the Swathe Clover root has been ploughed up late in the season, the turf has not rotted, the Wheat has been put in late, and the work is unsatisfactory. In this case the plant comes up pretty well, but in February it may be found a large proportion have damped off. A dressing of rape cake, or super-phosphate, or guano would have prevented this mischief. As it is the

Wireworm has its own way with the remaining plants, and the credit of having destroyed the whole of the crop.—(Ralph Lowe, Sleaford, Lincolnshire.)

If land is in good condition and in a high state of cultivation, Wireworm does not often seem to hurt the crops.—(M. Locke Blake, Ilminster.)

Injury from Wireworm is most severe when the corn is attacked just as the seeds are striking root,—that is, when the food supplies in the grain are exhausted, and the plant is beginning to depend on its roots for nourishment. When the plant has reached the height of six or eight inches it does not fall back so readily under attack.—(Robert Coupar, Old Sccone, N.B.)

I observe that when the Turnip plant is attacked in its young state—that is, when about two inches high—that the Wireworm nips into the centre of the root and the plant dies, but when the plants get a little stronger, and one or two fibres begin to spring out from the sides, the plant receives little harm.—(R. Renton, Earlston, N.B.)

The quicker you can get the seed to germinate and grow the less injury the Wireworm can do, but in dry weather and cold nights the Wireworm will do much mischief.

I consider that by sowing 2 cwt. of rape cake per acre the crop may be partially saved, as the Wireworm will feed on this while the seed is growing, and thus get a good start.—(Joseph Addison, Mapledurwell, Basingstoke.)

The application of artificial manure is doubtless an assistance to the plant, by strengthening it, and causing it to tiller out, and so in part to compensate for the damage done.

The Wireworm is most destructive during a cold, dry season, with east wind prevailing; in short, when the growth of the plant is suspended. After a copious fall of warm rain the destruction is seen to cease, and the plant to revive.—(David Rowland, Titley, Herefordshire.)

There seem to be two plans for trying to get rid of the Wireworm—one the starvation of the worm by fallowing; the other by the application of something strengthening to the crop, and, if possible, also injurious to the worm. Rolling and hoeing are resorted to,—anything, in fact, which may push on the crop and disturb the worm.—(R. Cooke, Detling, Maidstone.)

. . . . Having arrested their progress, it is advisable to resort to the most highly stimulating manures, and with no sparing hand, in order to force the remaining plants to such a degree as to enable them to cover the ground, and become sufficiently strong to resist the attack of the worms that may escape from their imprisonment, or may hatch afterwards.

Here again is another point in favour of keeping land in the very

highest state of cultivation, both as to manure and mechanical condition. Weeds should on no account be allowed in anything but a state of infancy, as if permitted to cover the ground they weaken the crops and afford a ready supply of cover and food to the pest.—(Adam Lee, Lydbury North, for the Right Hon. the Earl of Powis.)

Manures, into the composition of which sulphuric acid largely enters, are thought when drilled with Turnip seed to repel the Wireworm, but I do not consider that any caustic manure or rape cake put into the land will in any way affect Wireworm, except as stimulating the rapid growth of the plants.

On light lands probably the application of—

2 cwt. of Rape Cake, at the cost of	.	.	7s.
2 , , Superphosphate	,	.	8s.
1 , , Kainite	,	.	6s.
Total			21s.

per acre will be found one of the best fertilizers for Wheat. When sown broadcast at the time of drilling the seed this carries the plant out of reach of attack, and gives a satisfactory return on all light soil. On clay it is useless.—(Ralph Lowe, Sleaford, Lincolnshire.)

If the crops are attacked the best means that I have noticed for saving them is to dress these (white straw crops) with some nitrogenous manures, such as nitrate of soda, by which they are induced to grow away fast from the pest which prefers very young growth.—(Robert L. Pudney, Halstead, Essex.)

The use of artificial manures, nitrate of soda to the corn crops and superphosphates to the root crops, I have no doubt is the proper thing, so as to push the young plants on as quickly as possible.—T. R. Hulbert, North Cerney, Cirencester.)

In a 20 acre Clover ley, dunged and sown with Wheat, a strip right through was attacked rather severely. This was rolled, and *nitrate of soda* was applied, and at harvest this part was quite as good as the rest of the field.—(R. Cooke, Detling, Maidstone.)

The only manure used as a top dressing is soot, and this is an excellent remedy against Wireworm and a valuable manure.—(H. Hayward, Blakemere, Hereford.)

We suffer but little from the ravages of Wireworm in this district. Its effects are chiefly observable where the soil is somewhat poor, and too open and porous. It is considered it can best be kept under by dressing with lime, soot, and salt, and severe rolling.—(Rev. G. T. Blomfield, Norton, Ilminster.)

Turnips sown May 25th were ready for thinning June 20th, but on June 22nd so many of the plants were found to be dying from attack of Wireworm that we did not thin until eight days later, to allow them

to get stronger. Then I believe an eighth part of the plants were destroyed, but as they had been sown very thick there were plenty of plants left, and being fine growing weather at the time they began to do well.

As a stimulus a part was sown with nitrate of soda, 2 cwt. per acre ; another part with common salt, 4 cwt. per acre ; and another with dissolved bones and guano, 3 cwt. per acre, or thereabouts. It was plain that the nitrate of soda answered best, and the whole was re-sown with it. Now the crop is a pretty fair one, but I believe if nothing had been done it would have been lost.—(R. Renton, Earlston, N.B.)

Observations regarding Wireworm being attracted by Farmyard Manure.

Some farmers consider that spring crops sown on land that has been dressed with farmyard manure are more infested with Wireworm than those sown on land dressed with artificial manures. I think artificial manures are of great use, as on every account it is good to force on the plant at the time the insect is at its work.

In this part of the country (Pen Pont Farm, near Brecon) ferns are used in great quantity by most farmers for bedding purposes, but in one locality it is considered that the Wireworm occurs in such numbers in manure made from ferns that the farmer will not allow a load of these to be brought into his yard, and I have seen Potatoes planted in manure made chiefly from ferns very badly infested by Wireworm.—(Thomas Jones, Penpont Farm, Brecon.)

I have noticed in former years that portions of land which have been treated with farmyard manure have been seriously attacked by Wireworm, while adjoining portions, covered with ashes, road-scrapings, &c., have at the same time been entirely free from them.—(L. P. Williams, Penberry, St. David's.

I think heavy dressing with farmyard manure helps to encourage Wireworm.—(J. Prince, Foston, Derby.)

It is a well-known fact that salt is an effective preventive of Grub and Wireworm in cornfields, and besides is valuable as a fertilizer, and in strengthening straw grown on land deficient in saline matter.

If farmyard manure, and especially stable dung, was turned over and salted in spring, or salted after being spread in the drills previously to being covered, I believe we should have much less Grub of all sorts. —(James Kay, Bute Estates, Rothesay.)

The above points are well worth further observation and consideration, for one great principle of prevention for Wireworm attack is to press the land so firmly that the Wireworms have not free passage in the soil, and it is plain this state cannot be thoroughly attained where farm manure is used in the condition in which it is commonly applied to the soil, and where large quantities of any kind of vegetable matter

that takes long in rotting are added, the difficulty of course is much increased.

Further, it has been observed that the Wireworm of the common-striped Click Beetle, *Agricotes lineatus*, Esch., has been found (and sometimes in great numbers) in dung, and in vegetable manure or vegetable earth; and thoroughly rotted horse dung has been found to be a feeding-place for the Wireworm of the Black Click Beetle, *Athous niger*, Linn., and consequently these kinds, and conjecturally several others (whose habits, as far as we know, are very similar), may thus be easily carried out to the coming crop in the manure.—(Ed.)

ROLLING AND TREADING WITH SHEEP, &c.

Notes of Wireworm being most destructive on light and friable soil, or when land is in this condition from weather effects, such as are caused by long frosts.—Pressure of the land by rolling, or by treading with sheep, or other measures, calculated to compress the soil firmly, and thus keep the Wireworms from travelling, strongly recommended both as methods of prevention, and also as remedies when attack is present.

Wireworm infests land of almost all descriptions, but more frequently those of a light, friable, and dry, or moderately dry, texture. It seems to delight in being able to run freely from one plant to another, and damages all crops more or less, but its effects are never so plainly visible as in the early spring to the Wheat, Barley, Oats, small Turnips, and other plants.

Where measures of prevention have been unthought of, or have failed, and the young crop is attacked, the first thing to be done would be to roll with a heavy flat, smooth roller, or with a Cambridge roller or ring roller first, and a flat one to follow, and this should be done when the land is as wet as it is possible to work the implement on free of clogging, in order to arrest the progress of the Worm from one plant to another.

To drive sheep over it until no part can be seen without a sheep track is also a good plan, but is heavy work for the sheep.—(Adam Lee, Lydbury North, for the Right Hon. the Earl of Powis.)

Rolling after sowing is generally admitted to be the best preventive. By rendering the soil firm and compressed it prevents the ready passage of the Wireworm from plant to plant, and thereby localises the damage.

Where crops are affected rolling or treading by sheep where practicable is a plan universally adopted, and is, I think, the best remedy.—(David Rowland, Titley, Herefordshire.)

Rolling and treading at the time of sowing the seed have been found serviceable.—(Ralph Lowe, Sleaford, Lincolnshire.)

Wireworms are more active in the spring months after a long frost (on account of the land being more porous then) than they are in mild winters.

I have used 30 cwt. of gas lime to the acre on Clover ley, and harrowed the land a week or nine days before being ploughed up for Wheat with good effect, and put the shepherd to drive the *sheep close over* the field when the drill was planted. In March, if the land is dry enough, put *cattle* and *sheep to tread it*, and roll down. I do not think rolling does as much good as the *horses* do in treading, especially if they are driven three abreast.—(G. Burgiss, Farm Manager to the Right Hon. Earl of Winterton, Strutherghen Park, Petworth.)

No doubt in Hampshire the Wireworm is a scourge, but it is not numerous enough here (Downton) to cause us trouble. Our ground is heavily stocked with sheep, and probably their constantly treading interferes with its movements.

Most of our land carries sheep at least once a year, and much of it twice. Vetches *fed*, followed by roots, *fed*, alternated with the ploughings and dressings necessary for the cultivation of the crops, must be an unsatisfactory state of things to the Wireworms.

On poorer soils, where only about half the amount of sheep per acre is maintained, the Wireworm is to be found established more frequently.—(Professor John Wrightson, College of Agriculture, Downton).

Our treatment of land where crops are affected is frequent use of heavy ring roller, and steady driving of sheep backwards and forwards over the land.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

The firmer the land the better; consequently have often used *sheep* on the Wheat land when too wet for rolling. Good cultivation, plenty of harrowing, &c., is always beneficial.—(T. R. Hulbert, North Cerney, Cirencester.)

Treading the ground with *sheep* and *cattle* and *rolling* with a heavy roller are good measures for killing the Worms.—(John Sutherland, Berridale, Caithness.)

If the Wireworms attack a crop the only way I have found to stop them is to get the land into as firm condition as possible; if the land is open they can travel easily from plant to plant, and may often be seen working up a drill and killing all the plants in succession. If the land is firm and hard pressed the Wireworm has more difficulty in working about in it. *Rolling* constantly with a heavy roller, or turning *sheep* backwards and forwards on the ground, is the only way to get it properly consolidated.—(M. Locke Blake, near Ilminster.)

All light land subject to Wireworm ought to be *rolled* twice with a ring roller as soon as the seed is sown, either in the autumn or

spring. You cannot well get the land too firm.—(Joseph Addison, Mapledurwell, Basingstoke.)

On the chalk at Mere Down, Wiltshire, it is noted that the *Cambridge ring roller* is the best remedy, the heavier the better, and that it should be passed over the same land two or three times.—(Thomas Henry Baker, Mere, Wilts.)

I have tried rolling, both with and without salt, and salting without rolling, the two former with good effect, the latter apparently with none. This year being particularly favourable for rolling the Wheat crop, it was all well rolled in good time, and we have not suffered.—(A. H. Bowles, Clandon, Guildford.)

I have suffered considerable loss by the ravages of the Wireworm in my Wheat plant on land where the previous crop was seeds, and the most convenient method for destroying them is to roll the ground, and make it like the turnpike road. The Wireworms come to the surface and the crows take them.—(Thomas Allen, Thurcaston, Leicester.)

A field on my farm (on light soil, sea coast of Pembrokeshire), which has been under grass since 1878, was ploughed 2 ins. deep in the spring of this year. A second ploughing during April went to $4\frac{1}{2}$ ins. deep. No manure was applied, and it was sown with Barley. The Wireworms soon appeared, more especially in the bores, when a heavy *Crosskill's ribbed roller* was used, first across the furrows, and afterwards along them. This had the desired effect, the Wireworm practically disappeared, and a good average crop of Barley followed.—(L. P. Williams, Penberry, St. David's.)

It is a general custom when crops of Barley or Oats are injured to use the *Cambridge roller* as soon as possible, which no doubt does good, as it kills some of the insects and helps to keep alive the plant which had been partially destroyed.—(Thos. Jones, Penpont Farm, Brecon.)

I have found that compressing the soil before sowing the crop, and during the early growth of the plant, has to a limited extent prevented the Worm from working. Hoeing the crop is also good; in short, any means of disturbing the Worms or hastening the growth of the plant, to enable it to get away from their attacks, is beneficial.—(Frederic Beard.)

MUSTARD.

Notes of the serviceableness of Mustard as a preventive for Wireworm: also instances of Wireworm not being observed as attacking various leguminous crops, as Clover, Peas, &c., if no grass was present, either as a part of the crop or as a weed amongst it.

It has been found by practical experience that the growing and ploughing in of White Mustard will get rid of Wireworm. The use of

Mustard as a growing manure crop is not sufficiently resorted to.—(Per Chas. Caswell, Peterborough.)

Mustard sown thickly and allowed to grow to a considerable length, and then ploughed in, has been found to be a good preventive, and at the same time adding considerably to the fertility of the land.—(Adam Lee, Lydbury North, Shropshire, for the Right Hon. the Earl of Powis.)

Found Mustard a good preventive, and sometimes the only safe crop to sow where Wireworm prevailed.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

I think Mustard acts as a preventive.—(Geo. Burgiss, The Farm, Strutherglen, Petworth.)

For fallow after cleaning sow Rape or Mustard Seed about the end of July, and plough it under when about a foot or eighteen inches high. (Contributed by J. Craig, Shifnal, Salop.)

The Wireworm has been known to disappear after a crop of White Mustard, of which one-half was eaten on the ground by sheep.—(Joseph Paget, Mansfield.)

I have no doubt of Mustard being a good remedy where it can be applied so as to be ploughed in for the crop.

I would suggest that Flax should be substituted for the Corn crop on all land most liable to the ravages of Wireworm, especially now that the fibre, harvested and threshed, can be utilized for paper-making, thus opening up a new and remunerative article of farm produce.

I have heard (and believe) it is invulnerable to the Wireworm, but cannot speak on the fact from my own experience.*—(T. R. Hulbert, North Cerney, Cirencester.)

White Mustard sown and allowed to stand until it comes into flower is a very useful preparation—when ploughed in and pressed—for all corn, and, I think, prevents the Wireworm doing so much mischief.—(Joseph Addison, Mapledurwell, Basingstoke.)

I have never known Wireworm troublesome after Mustard or Vetches.—(M. Locke Blake, Ilminster.)

I have not found that Red Clover encourages Wireworm, but where mixed seeds and much Rye Grass are used I have found these very productive of Wireworm. The best remedy, and one frequently adopted, is to break up early and plant Mustard, which is an excellent preparation for Wheat, and I have found Mustard the best preventive of attack.—(H. Hayward, Hereford.)

I have not noticed Wheat after Clovers, Beans, or Peas affected, if no grass had grown among those crops. As for remedies, I can

* The only Beetles that I find reference to as injuring the Flax crops in their perfect or grub state are the Cockchafer and a kind of Flea Beetle.—ED.

only suggest clean cultivation, sowing the *Clover Seeds* only for feeding or hay, if Wheat or Oats is to be taken as the next crop.—(Robert L. Pudney, Halstead, Essex.)

I have never known Peas attacked by Wireworm.—(T. H. Baker, Mere, Wilts.)

PRESENCE AFTER CERTAIN CROPS.

Presence of Wireworms after certain crops, such as Grass, Clover, &c.; also after crops which, by reason of the amount of stalks or stumps remaining from them in the ground, give thereby shelter to the Wireworms, or cause the soil to be open and unconsolidated.

My experience of Wireworm in excess was on land reclaimed by the spade from old turf, covered with furze, ferns, and such like, inhabited by birds of various kinds, devouring beetles, worms, &c. The land was sown to Oats, which were devoured by Wireworm, the wild birds having been scared by the continued presence of workmen. The roller, sheep-treading, and any means available to compress the land were used. The Turnip crop in succession was destroyed. Pressure was again applied, and the land left without a crop. In the spring and summer birds fed in great numbers on the land. A crop of Mustard was sown and fed off by sheep. Then Oats and Seeds for two years, and no more trouble with Wireworms.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

We generally get Wireworm in land which has lain down to grass two or three years, or after a crop of Sainfoin, which has been down some time. On the light land in this hill district (on the chalk formation) old leys are often broken up and sown with Oats, which rarely suffer from Wireworm, but the following year we generally find them, and in succeeding years they are often very troublesome.

In 1873 a piece of Sainfoin, which had been in existence for ten years, was broken up and sown to Oats, in which no Wireworm appeared. The next autumn Vetches were sown after the Oats, and produced a good crop. These were fed off in 1874 by sheep, and the land was sown to Rape. *This was entirely destroyed by Wireworms.* Then it was sown to Mustard, which was also eaten by them as soon as it came up, and is the only instance which has ever come under my observation of this crop being attacked by Wireworms. Then the land was sown to Wheat, and no Wireworm put in an appearance, neither have I seen any there since of any consequence.—(T. H. Baker, Mere, Wilts.)

Old turf is generally found (on being broken up) the *most* likely to be full of Wireworm, and requires the utmost care before being turned over, and very great watchfulness afterwards. Next to this "seeds" which have lain two or more years would be most likely to prove

troublesome; then those seeds which have only lain one season. Vetches and Peas are fouling crops, and give shelter to the Worm.--(Adam Lee, Lydbury North, Shropshire, for the Right Hon. the Earl of Powis.)

The cereal crops seem to be the most often affected by Wireworms. Wheat, for instance, if sown after "seeds" (containing grasses), is particularly liable to attack, and Wheat sown on weedy land, especially if the weeds be wild grasses, such as the long "water grass," often very common on wet land. I judge that the eggs are laid in the dead grass rubbish on the field, and that when the young crops are sown and growing (even from January during the spring of the year, if there be no frosts) the Wireworm pursues its way from plant to plant, half burying itself in the tender stalk, and then, after eating out its heart, leaving it for another.

Mangolds when young are often attacked and destroyed if sown after weedy white straw crops that have likewise suffered from the Wireworms.--(Robert L. Pudney, Halstead, Essex.)

Land is more subject to Wireworms after Clover and Beans, but there is no crop that increases Wireworm so much as "Couch" and weeds, and often when land has been fallowed the previous summer the Wireworms are quite as destructive in the next spring as they are on the Clover ley Wheat.--(G. Burgiss, The Farm, Strutherford, Petworth.)

Certainly I think there is more danger from Wireworms after Clover than after any other crop. I believe after a crop of Beans or Cabbage they are also troublesome, but consider this may be because if a large amount of Bean-stalks or Cabbage-stumps are ploughed down the land would lie so open it could not be properly consolidated by rolling, and the Wireworm would have a chance to harbour and work in the stumps. After these crops, therefore, the land should be got as free as possible from stalks and stumps, as well as weeds, before ploughing.--(M. Locke Blake, Ilminster.)

I have observed that the Wireworms have appeared upon land immediately after a Turnip crop when not grazed by sheep or other animals. I have hitherto supposed that the appearance of the Wireworms after Turnips was due to the pulverized condition of the soil rather than to the nature of the preceding crop.--(L. P. Williams, Penberry, St. David's.)

SALT AND KAINITE.

Notes of heavy dressing with salt being found serviceable to kill Couch-grass, and also to destroy or drive away Wireworm. Lighter dressings found useful in promoting vigorous growth of Wheat. Salt also serviceable in garden cultivation to protect Cabbage from Wireworm attack. Observations of benefit from use of Kainite.

Salt at the rate of 5 or 6 cwt. per acre on light land is considered useful if sown before breaking Sainfoin or Clover ley.—(Joseph Addison, near Basingstoke.)

In former years I have experienced much benefit from the use of common salt, applied at the rate of 5 cwt. to the acre.—(L. P. Williams, Penberry, St. David's.)

An old ley was dressed with 10 cwt. of salt per acre in the autumn, and the salt ploughed in. This plan not only killed the Couch and Twitch, but on this piece of land there was no trouble from Wireworm, or from Grub, and none has been known to occur since.—(Per C. E. Curtis, Alton, Hants.)

I have known a heavy dressing of salt (10 or 12 cwt. per acre), applied some weeks previous to sowing, to have a good effect.

On the lighter lands of Radnorshire I have observed that Wireworm is most destructive on old and poor grass land ploughed up for Oats. The land being light, porous, and exhausted, offers every facility for the action of Wireworm. In such cases two or three crops are frequently destroyed in succession.

The general treatment is to *lime and salt liberally*, and to tread the land by consuming the root crops with sheep.

On the other hand, I have known strong loam, rich with farm-yard dung and artificial manure, but *without lime or salt*, suffer severely. I do not think that either salt or lime will directly kill Wireworm, but I venture to suggest that soil thoroughly impregnated with one or both may become an unfitting abode for it.—(David Rowland, Titley, Herefordshire.)

For six years previous to the year 1873 every crop in a 13-acre field belonging to me, and in my occupation, was more or less attacked by Wireworm. I farmed the field on the four-course system, and on two occasions four acres of Wheat in the middle of the field were destroyed by Wireworm. In 1873 the field was a Clover ley, and was dressed with 8 cwt. of salt to the acre previous to ploughing for Wheat, and 5 cwt. of damaged decorticated cotton cake per acre was also put on it at the time the Wheat was sown (the cake was best decorticated cotton cake, but had been a little damaged by fire, and cost £5 per ton delivered at my station). The crop of Wheat was very

good, and that portion where the Wireworm had previously done so much damage was the best. Every crop has since done well, and there has been no return of the pest.—(James Whitaker, Worthen, Shrewsbury.)

A piece of old turf on light soil broken up for Oats was then sowed with Turnips eaten off by lambs. This was next worked for Potatoes, and large quantities of Wireworms were observable. Two loads of common salt were procured and sowed broadcast, and it was not found that any of the Potatoes were eaten by the Wireworms.—(S. Massey, Church Lawton, Cheshire.)

I had two fields in Clover last year, both heavy crops, and each dug up in the autumn. One was sown with about 4 cwt. of salt per acre, the other left without any dressing. No Wireworm has appeared on either, but the salted field is more than double the crop in both thickness and vigour, though I should incline to say the other field was naturally rather the better, and both were treated to exactly the same quantity of manure last year. So we may say that the salt (even minus the effect on Wireworm) has had a valuable effect.

I see some few fields worked by Wireworms principally after Wheat, which was itself worked by Wireworm last year, and being a late cut crop (the worst field was not cut at all, and was shooting until the end of September, 1881) probably the eggs were laid in the crop of weeds at the bottom.—(George W. Latham, Sandbach, Cheshire.)

When I see Cabbage, or any of the *Brassica* tribe, showing signs of Wireworms being at the root, I put a ring of salt about three inches from the stem around each plant. This either kills or disperses the Wireworm, and the plant makes fresh roots and does well. In very dry weather the plants require watering with a rose after the application of the salt.—(Per J. Craig, Shifnal, Salop.)

KAINITE.

In the year 1871 my attention was called to the damage done to a field of Wheat by the Wireworm, nearly one sixth of which was destroyed by them. I was induced to try the effect of Leopoldshall Kainite, and applied a dressing of about 3 cwt. per acre to the whole field, at the same time applying superphosphate and nitrate of soda. The Wireworms did no further damage.

Some two or three years after I noticed many Wireworms when my Potatoes were got up, and just before sowing with Wheat I applied 5 cwt. of Kainite to the Potato ground (one acre), none being applied to the other part, where Mangolds were growing. In the following spring the land which had received the Kainite was unhurt, whilst the other portion was thinned a good deal by the grub, and we had to

dress it also. I have frequently had to use the Kainite since, and I never knew it to fail if applied in time.—(T. S. T. Carrington, Uttoxeter.)

Regarding the attack of Wireworm there is never destruction to any great extent by it in this district (Blairgowrie). I have never had trouble from it to any extent, beyond small patches in a field. These I always dressed with nitrate of soda or Kainite salt, which I found to work well. The soil where I had to apply it was stiffish and mortar-like, where a proper mould could not easily be got. I applied the nitrate at the rate of about 2 cwt. per acre and the Kainite about 4 cwt., but I think more Kainite might be applied with advantage. Care must be taken to apply the salts when wet, otherwise there is a risk of burning the plants.—(T. H. Leslie, Blairgowrie, Perth.)

GAS-LIME AND ALKALI WASTE.

Application of gas lime as a means of clearing ground of Wireworms, with some notes on use of alkali waste and gas-tar water.

For several years a portion of one of my fields was infested with Wireworms, and in spite of rape cake and other supposed remedies every successive crop was more or less injured, until one autumn I ploughed in refuse gas-lime, and from that time have never seen a Wireworm in that field.—(The Right Hon. the Earl of Essex, Cassiobury, Watford.)

Branxholme, Hawick.—I do not think we are much troubled here with Wireworm, except in very old pastures, and then our usual plan is ploughing up and dressing with gas-lime.—(W. Elliott Lockhart, Hawick, N.B.)

For Clover leys I should put about 10 cwt. of gas-lime to the acre, and then plough it under. I think this is a great preventive. If used for Turnips sow it on broadcast and work it in, and then add what may be thought best for the crop.—(S. Massey, Church Lawton, Cheshire.)

I dressed a few acres with gas-lime in March, and it seems to have freed the ground wonderfully.—(John Heatley, Passingham, Wolverhampton.)

Some years ago complaint was made of the destruction of grain crops on a limited portion of a field of rather light soil. I advised the trial of gas-lime, and several cart-loads were applied, with the result that not a trace of Wireworm was seen for several years after.—(Jos. Ellans, Anglesey.)

ALKALI WASTE.

This material, which much resembles gas-lime in its properties, is sometimes largely used in the neighbourhood of alkali works, and is

valuable on account of its intensely caustic nature, which destroys all life in weeds or insects alike which it may come in contact with before its nature is altered by exposure to the air. After this the "waste" is a safe and serviceable manure usually procurable at a very small cost, or merely at the remover's expense of carriage from the works.*

The following communication is with regard to the use of alkali waste produced in the manufacture of soda ash at Widnes, Lancashire :—

The Lancashire farmers get the waste for carting, and use it in heavy dressings to mellow heavy land, and destroy perennial weeds, as Couch-grass, Coltsfoot, or Thistles, but a dressing of two or three tons per statute acre is as much as grass land will bear at one time, and then it must be spread quickly, or the heaps will destroy the grass roots as well as the herbage.

This quantity per acre will be very fatal to the Wireworm, and is surprisingly penetrating. After much rain, drains three feet deep in a heavy soil yield milky white water after an application of two or three tons per acre.

On arable land five tons per acre is a good dressing, and fatal to all insect and worm life; deep-rooted perennial weeds require more, especially Coltsfoot.

This waste and gas-line are somewhat similar in nature and action, but the waste is more caustic, and contains about two per cent. of soda, very valuable in agriculture. It loses the caustic nature when exposed to air and moisture, and the rule is to leave it on the surface of arable land, exposed to air and rain, for at least six weeks before ploughing it in. If it is buried in the soil before it has lost its caustic properties it destroys the seed, &c., when sown.

Care is requisite in carting it in wet weather, or any liquid drippings falling on the horse take off the hair, and make the skin raw and blistered.—(John Crompton, Rivington, Chorley.)

Many people in the neighbourhood of Widnes use the chemical waste for killing worms, and also for manure on strong land.—(Per S. Fitton, Nantwich.)

GAS TAR WATER.

Four years ago I had a field of nine acres on light good gravelly soil in Wheat after Oats, and in February the plant commenced dying.

* For further particulars see "Alkali Waste," pp. 616, 617, 'Journal of Royal Agricultural Society,' vol. x., 1st series. From this it appears that alkali waste when fresh possesses caustic properties which are highly dangerous to vegetation, but after a time, by exposure to the air, the sulphur compounds become altered in their nature, and "essentially, then, alkali waste consists of sulphate and carbonate of lime, and may be used with advantage and economy wherever gypsum would be of use."

Rape dust, heavy rolling, and nitrate of soda, at the rate of 2 cwt. per acre, were successively tried, but little benefit appeared to result. I then, as we have gas made near, got a water-cart about half filled with the water off the gas-tar, and diluted it just weak enough not to kill the plant, and applied it by means of a watering-can, and found a most beneficial result.—(J. Prince, Foston, Derby.)

RAPE CAKE, MEAL, &c.

*Communications regarding the serviceableness of various kinds of Rape cake, nuts, or meal in diminishing amount of injury from Wireworm attack, whether by acting as a fertilizer or by attracting the Wireworm away from the crop. **

Found Rape cake of great service in stopping the ravages of Wire-worms to growing crops, either because they preferred it to the plants (as could be seen by the presence of many eating their way into the lumps of cake), or, as some asserted, by poisoning them.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

* I have no doubt that the Rape cake I have used acted as a stimulus to the crop, the Barley being much heavier on the portion of the field dressed with Rape cake than on the other portion; but as the part on which the cake was sown was previously infested with Wire-worm I believe it attracted the Wireworms from the plant. It may have killed them also, but of that I am not sure.—(George McQueen, Coed-y-Dinas, Welch Pool.)

* About the application of Rape dust to the land to destroy Wire-worm, I may say that in 1874 I got two tons of very fine Rape dust (as fine as flour). I mixed it up with the Turnip manure, and sowed it in the drills in the usual manner. The result was very good. There was no Wireworm, and the crows did not look for any, but on about an acre of the field that got no Rape dust the Worm was bad and the crows pulled the Turnips. In 1875 I used three tons with the same good result. Of course it has a certain value as manure as well. —(Edward Gordon, Mains of Kelton, Kirkcudbright.)

Rape cake sown on the land has been found of much benefit.—(Adam Lee, Lydbury North, Shropshire.)

I have seen very good results from the application of artificial manure, particularly from Rape cake. The Wireworm is very fond of this food, and by leaving the crop in order to feed on the cake thus frees the plant from attack.—(Fred Beard, Horton, Canterbury.)

Rape cake of good quality is an excellent fertilizer for Wheat when sown at the same time, and Turnips do well as the following crop, but

* The entries to which an asterisk is prefixed refer to observations regarding Indian rape, i.e., mustard cake.

I do not think that it would have more effect upon the Wireworm than superphosphates or other applications of equal value as fertilizers.—(Ralph Lowe, Sleaford, Lincolnshire.)

* Barbersham Castle, Straffan, Ireland.—I took this farm twelve years ago; it had principally been a grazing farm. A year afterwards I ploughed up a field of sixteen acres of old ley, and sowed it with sixteen bushels of Oats. It braided very well, but very soon it began to show signs of the Wireworm, and I scarcely got back the seed. After that I sowed fine ground Rape meal, mixed with the seeds, and have never had anything like the loss I had before doing so.

My mode of treatment has generally been to mix Oats and fine Rape meal together, put them in the hopper of Hornsby's Sowing Machine, and sow this once up and down and then across, so by that both corn and meal are nicely divided over the field, and from that I generally have a beautiful braid and very good crops.—(Charles Littleboy, Straffan, Leinster.)

About eight years ago I enclosed a piece of old pasture land, and converted it into a vegetable garden. The first year the Cabbages were destroyed, and large holes eaten in the Potatoes by Wireworm, and I dressed the garden thoroughly with lime, salt, and soot, but notwithstanding the vegetables were destroyed in the second year nearly as badly as before. I then covered the garden with Rape nuts, and have had no Wireworm since.—(R. Paver-Cron, Ornham Hall, Boroughbridge.)

The following experiments were tried in consequence of the belief often expressed that Wireworms feed so greedily on rape cake that they burst. This, however, I did not find to occur in any instance.

Through the courtesy of the manager of the Phoenix Oil Mills, Liverpool, and of Messrs. Ayre, Waterloo Mills, Hull, I was supplied well with the "Indian" Rape cake from the former, and with Black Sea Rape cake from the latter firm. These two kinds are both known to be serviceable for manure, but I found them somewhat different in their action on the Wireworms.

The Indian, or Kurrachee, cake is formed from Mustard seed. This I pounded into small lumps and dust, and mixed it with water, and then placed a good supply of healthy Wireworms on it with a little bit of turf. For about three days the smell of Mustard was very powerful, and the Wireworms would not leave their turf, and those that were placed on the Mustard cake, which presumably had still its stinging powers, appeared very uneasy. About the fourth day a putrescent smell succeeded that of Mustard, and the Wireworms began to go into the cake, where they fed (or, at least, I presume they fed, as there was nothing else for food) for about a fortnight. They seemed all well and thriving until the end of the fortnight, when I

found many dead or dying. I put fresh turf and broken potato and turnip, in addition to the cake, but all died.

The Wireworms which I placed on Black Sea Rape cake (that is, true Rape), broken and moistened as above mentioned, went into it at once and, like the others, fed (or appeared to feed, having no other supply); but whereas the Mustard-cake Wireworms died in about a fortnight, these were still alive at a period of three weeks or more after being put on the cake. I cannot tell how much longer they would have lived, for it was difficult to keep the cake in an evenly moist state, and by disturbance in examinations and possibly by attacks of birds the specimens lessened in number, but from August 2nd to August 22nd might be taken as a time during which they were thriving. None of the Wireworms which were experimented on burst from effects of eating, but it frequently occurred that when one was dead, or had so stiffened itself that it was cracked across in being moved, that consequently its white contents burst out where it was broken, and this may not improbably have given rise to the belief above referred to.—(ED.)

WIREWORM IN HOP LAND.

Wireworms frequently are most injurious to Hop plants, especially in fresh-planted grounds. These are the larvæ of the striped "Click Beetle," *Elater lineatus*, and they attack the "sets" or cuttings put in to form the Hop stocks directly they are planted. They bore into the juicy part of the stems of the sets, and suck out the sap and gnaw off the shoots as fast as they make their appearance. Old meadows and orchards are often converted into Hop grounds, and in these sometimes the mischief caused by Wireworm is very great, and unless expensive means are adopted to catch them two or three years elapse before a good plant can be obtained.

Planters do not like to pare and burn the turf with the humus, as it affords so much food to the plants if it is turned in and buried deeply, and all that can be done in these circumstances is to feed the sward off as closely as possible before it is ploughed in.

As Hop land is usually kept particularly free from weeds, and the Hop plants are set from $5\frac{1}{2}$ feet to $6\frac{1}{2}$ feet apart, the food for the Wireworm is not plentiful, and they therefore concentrate their attacks perforce upon the Hop plants.

The soil is often disturbed by the nidgetts between the plants, and by the spud around them, so that for the sake of peace and quietness they take refuge in the plant centres, and soon destroy the plants if they are not checked. If Hop plants show signs of weakness and decay they should be closely examined for Wireworm. Even in well-established Hop ground, that has been planted for a considerable time,

Wireworms do much harm, and weakness and slackness of bine, which is often produced by their attacks, is attributed to other causes, such as the unsuitableness of the subsoil, or the want of manure, or influences of climate.

When the presence of Wireworms is discovered in the plant centres they can only be got rid of by catching them; they are beyond the reach of caustic applications, and of the effects of rolling and nidgetting. In these circumstances traps should be laid for them in the shape of small pieces of rape-cake, mangel-wurzel, turnip, or carrot, placed close to each "hill" or plant centre, but the best of all these is the rape-cake. The Wireworms soon discover these tempting baits, and speedily bury themselves in them, and women are employed to look at them twice or three times a week, and take out the Wireworms snugly ensconced therein. As many as 200 Wireworms have been taken in this way from one plant centre in the course of three weeks or a month. It is a fallacy to imagine that rape-cake directly causes the death of the Wireworms by inducing them to gorge until they burst. Rape-cake acts, as has been shown above, as a capital trap by which they may be caught, and got rid of; or when it is applied broadcast to Hops or Corn by taking their attention from the plants which they had attacked before the rape was applied.

I saw a striking instance of this last spring in the case of a field of Oats taken after Wheat, in which the plants were looking thin, patchy, and sickly from the attack of Wireworm; 6 cwt. of rape-dust were put on per acre, which diverted the insects from the plants, and at the same time stimulated their flagging energies. The crop was the stoutest I ever saw, and yielded close upon eleven quarters per acre. If the straw had not gone down in places after the deluge of rain the yield would have been greater.

Rape-cake is very largely and generally used as a fertilizer for Hops, and there is no doubt Wireworms are encouraged to a certain extent by its extensive employment in Hop land, but it is certain that they will not prey upon the Hop plants so long as rape-cake is obtainable. I have tried to oust Wireworms from Hop plants by putting nitrate of soda, and lime, and soot close round the hills, but the results were not satisfactory. To prevent Wireworm attack the Hop land should be kept very clean, and the weeds and grass growing on the outsides and hedgerows carefully kept down.—(Charles Whitehead, Barming House, Maidstone.)

HANDPICKING.

Where Wireworms are unusually numerous upon Turnips there cannot be a more effective or cheaper method of dealing with them than that of picking them by hand.

A field of seventy acres between Sleaford and Lincoln, which was sown with common Turnips, and a full plant nearly ready for the hoe, was found to be infested with Wireworms of different ages. A number of girls were set to work, and taking each a drill row, and guided by the different colour or withered appearance of the plant, by a quick movement of the finger dislodged the "worms," and picking them up placed them in a small bottle carried in the left hand. These Wireworms were greedily eaten by the poultry.—(Ralph Lowe, Sleaford, Lincolnshire.)

I have seen the Wireworm caught in large numbers by placing sliced roots in Hop hills, women doing the work, and being paid by measure, a successful but expensive plan.—(Fred. Beard, Horton, Canterbury.)

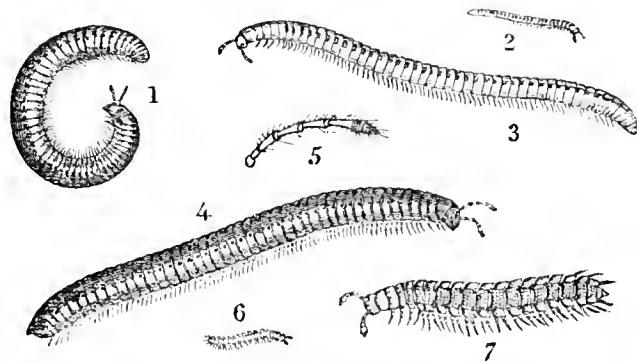
I have not been a sufferer from Wireworm ravage this year, but a neighbour has found them cause considerable damage among young Hops, so much so that he opened each hill, and inserted pieces of potato in every one. The next day the Wireworms had chosen the potatoes, and ten or a dozen were found boring into the pieces at each Hop root. At least two kinds were destroyed—the Wireworms, or larvæ of the Click Beetle, and the *Julus guttatus*.* This method proved effective, and saved his young plantations.—(D. Turvill, Alton, Hants.)

APPLICATION OF SEAWEED.

Orkney.—The island of Shapinsay is seven miles long and five miles broad, and is surrounded on the east by the German Ocean, on the

* The *Julus guttatus*, Fab. (*J. pulchellus* Leach) is one of the Snake Millipedes sometimes known as False Wireworms. These feed on vegetable matter, but how far they also feed as matter of regular diet on animal food, as worms, snails, &c., is not yet ascertained.

Polydesmus complanatus, Lin., the flattened Millipede, is another kind that sometimes does much damage to the roots of Wheat.



FALSE WIREWORMS.

Snake Millipedes.—1, *Julus Londinensis*; 2 and 3, *J. guttatus*, nat. size and magnified; 4, *J. terrestris*; 5, horn; 6 and 7, flattened Millipede, *Polydesmus complanatus*.—‘Farm Insects,’ “Skip-Jack and the Wireworm,” by A. M., &c.

north and west by the Atlantic. It is distant from Kirkwall four miles by sea.

Good crops are general when spring is warm and dry. The principal manure used for ley ground is *seaweed*, which probably accounts for the absence of Wireworm, which is quite unknown to the farmers in Orkney.—(Thos. McDonald, Kirkwall, Orkney.)

In regard to seaweed it is largely used all along the sea coast, where it can be procured. It gives good crops of all kinds, especially Turnips and Grass. Corn does well in dry seasons, but in wet it is liable to lodge, and the corn and straw is inferior. Seaweed is destructive to all kinds of insects, and I doubt not to the Wireworms also.—(John Sutherland, Berridale, Caithness.)

Isle of Mull.—The Wireworm is sometimes troublesome in the gardens, but on the farm crops it does very little damage; in fact it is very seldom seen. The farmers and crofters use a great quantity of seaweed, which I have no doubt is the reason why there is so little Wireworm.—(C. Grierson, Isle of Mull.)

From inquiry made at some of the coast farms it appears they are never troubled by Wireworm. It is quite possible that the seaweed applied to the soil is a preventive.—(D. Husband, Struthers, Cupar, Fife.)

Bodorgan, Anglesey.—As far as my information and observation go Wireworm is not very troublesome in this district. Seaweed is used a good deal by some of the small farmers about here, principally for Potatoes in sandy soil.—(Joseph Ellans, Anglesey.)

Rooks, &c.

Rooks serviceable by clearing large numbers of Wireworms, but also frequently injurious by pulling up the plants (especially Turnips after being singled) in search of their food. (For further observations regarding Rooks see tables and abstract of Isle of Man Report.)—Notes as to usefulness of other birds, and also of Moles.

In the month of May I opened the crops of several “Crows,” as we call them in Scotland (Rooks in England), and found them full of Wireworms. Earlier in the season I killed a Crow feeding on some damp grass land, and found about three dozen *Tipula* (Daddy long-legs) grubs in its crop. There is no doubt of the Crow, or Rook, being a valuable friend to the farmer in the spring months. Taking the seasons round, I am of the opinion, after long and careful observation, that the Rook does more good than harm to the farmer. No doubt if the birds are allowed to become too numerous, and insect food fails, they will fall on the crops rather heavily, but the cure is easy in that case, and in my experience of nearly a quarter of a century in

England, Scotland, and Ireland I have rarely seen it required.—(Malcolm Dunn, Dalkeith, N.B.)

Where Wireworms abound the Rooks, Plovers of different kinds, Partridges, and other birds feast, and are the best friends to the farmer.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

A good hoeing will help by disturbing the Wireworms and bringing them to the top, when Rooks will greedily search for them and devour them.—(Robert L. Pendrey, Halstead, Essex.)

The remedies I know are the ploughing in of Mustard, deep winter ploughing, and repeated stirrings of the land, but the best remedy is the one that Nature has given us in the assistance of Rooks and Starlings. I strictly preserve birds, and now I have no Wireworm.—(C. R. Colville, Lullington, Burton-on-Trent.)

Many Wireworms will be found early in the morning, say about four o'clock, and Crows are most serviceable in picking up these larvæ, especially in the mornings, when they will be found working hard in infested fields.—(Robert Coupar, Sccone, N.B.)

If we go to the fields at daybreak at the beginning of May we may observe the Rooks beating singly over every yard of ground, nothing appearing to escape their notice. These Rooks are providing for their young, and if the pouch of one of these birds is opened it will be found to contain a dozen sprouted barleycorns, a few dead dry earth worms, and upwards of thirty Click Beetles, soft and pulpy, which struggled up during the previous night from their chrysalids a few inches below ground. After six o'clock, the time when the horses go to work, a stream of Rooks may be seen coming and going, eagerly picking up Wireworms and Grubs in the furrows behind the light ploughs. Each Rook does not take fewer than fifty Wireworms during the day of eight hours, whilst the horses are at work, and later on (at the dusk hour) if the pouch of the latest Rook flying home be examined it will be found to be filled with Beetles, Caterpillars, and a little corn.*—(Ralph Lowe, Sleaford, Lincolnshire.)

Rooks Sometimes Destructive to the Crops.

Rooks will soon tell you where Wireworms are. I have often seen acres entirely cleared of good strong plants of roots by being pulled up by the Rook in search of his favourite food. Nothing requires greater attention on the farm than keeping Rooks off the roots when first singled out, where there is Wireworm among them, as the cure is often worse than the disease.—(T. R. Hulbert, North Cerney.)

* The observation as to the pouch of the Rook being filled with Beetles as it flies home "at the dusk hour" is particularly deserving of attention, as it is not generally known the Click Beetle may then be found in considerable numbers on the grass.—(Ed.)

The Wireworm does not do so much harm to the Turnips as the Crows do by pulling up the plants to get at the worm.—(R. Renton, Earlston, N.B.)

Two Pheasants were killed on the estate I manage, and in their crops were found 1500 Wireworms.—(Professor Charles E. Curtis, Farringdon, Hants.)

Owing, I think, to the large number of Moles, the Wireworm in this immediate neighbourhood (Longleat) is not much trouble.—(Wm. Taylor, Longleat Gardens, Warminster.)

Moles are very fond of Wireworms. You will always see them burrow most where the Worms are thickest. A neighbour of mine never kills any Moles, and has not done so for twelve years, and his crops are not so much destroyed as they used to be by Wireworms, but I think the cure almost, if not quite, as bad as the disease.—(D. Husband, Struthiers, Cupar, Fife.)

WEYBREAD, SUFFOLK.

Of the five communications with which I have been favoured, through the Rev. J. H. White, from the neighbourhood of Weybread, one makes mention of loss by Wireworm ravage amounting to a quarter of the crop; one mentions a quarter to half; and another notes the loss as usually a quarter, but sometimes half the crop.

The preventive measures advised are to plough soon enough, and keep the land solid, and to well bush and roll leys and pastures; also heavy rolling in spring to stop the Worm (as the looser the soil the worse the attack), and hand-hoeing and well rolling down the land are recommended. Artificial manure or nitrate of soda is recommended to run the crop on past the power of the Worm, and soot also is found useful, but no mention is made of the use of lime or of salt.

One observer notes that rolling and treading are very well on some soils, but when you have got the Worm you must humour it, and give it something to eat (? Rape-cake.—ED.) until it changes its state or the crop beats it. “Seeds and certain grasses which harbour the Worm, and in which it delights to breed, of course increase the scourge.”

“A certain amount” of Rooks are advised, and for Moles see below.

Having found that Wireworms were the favourite food of Moles, I determined (having first drained the land) not to destroy any more of the Moles, but to let them destroy the Wireworm, which having accomplished they speedily deserted my land.—(G. W. Pretty, Fressingfield, Harleston.)

ISLE OF MAN.

Abstract, Observations, and Tables.

The following information regarding Wireworm and means used for its prevention in the Isle of Man has been kindly forwarded by residents in the island, in reply to forms arranged and circulated by Mr. Philip M. C. Kermode, to whom I am indebted both for his assistance in procuring these contributions and also for explanations and details which space does not allow insertion of in full.

For convenience of reference the greater part of the information reported is given in tabulated form, the name of the parish in which the observations were taken being prefixed in the first column with numbers to distinguish the different localities; but in deference to the implied wishes of the contributors their names are not given. In the following abstract the main points noted in the tables are given in connected form, together with a longer report and observations from Mr. McWhannel, of Glenduff, which could not conveniently be condensed:—

From these returns it appears that Wireworm attack often occurs to a serious amount in various localities in the island, but that the damage this year has been less than in previous ones. Three of the largest amounts of loss specified are about a quarter of the crop of Wheat, or two bolls to the acre; two bolls of Wheat and of Oats per acre; and about one boll per acre of Oats. The last mentioned is noted as about the same loss as last year, the two previous amounts of injury as less "than usual," or "in some previous years." *

Another observer notes loss of £1 10s. per acre last year in Wheat. Turnips have been injured up to loss of half the crop; of $1\frac{1}{2}$ ton per acre; and in one case to a produce of only six, instead of fifteen tons, which was expected per acre. Carrots have suffered loss of half the crop in one locality, and in another were last year damaged at the rate of £10 per acre.

In some cases greater or less amount of attack corresponds with nature of soil. Taking four of the northern parishes of the island, we find no loss on the black soil at two localities noted in Kirk Andreas; injury at several places in Leyzayre on light soil, running to gravelly loam not on strong earthy soil; at Kirk Bride injury in this or preceding years to some extent on light soil. In Jurby attack

* In the Isle of Man a boll of Barley or of Oats is equal to six bushels, and a boll of Wheat to four bushels, weighing 64 lbs. to the bushel. The word "bruit" signifies the young plant when just appearing above ground, and until grown an inch or so in height.

occurs on gravel and sand, but less on light land, possibly from regular use of liquid manure, and looking at the returns as a whole they appear to show both absence or presence of Wireworm more or less on all kinds of soils.

For direct remedy the customary treatment of rolling is advised, together with applications which may make the ground unsuitable to the Wireworm, or may push on vigorous growth of the plant—as gashlime, salt, soot, and also guano and liquid manure.

Seaweed is a good deal used in the island, and its application as a manure is noted at three places where slight attack of Wireworm occurred, but in reply to inquiries on this subject many contributors have entered "no seaweed used." I have not thought it necessary to note the non-application.

Lime also appears to be very seldom used, but—judging by the returns—to have a good effect when it is applied, and especially in one instance, where a liming a few years ago was followed in the present season by the application of kainite and superphosphate.

The observations regarding Rooks are well worth consideration, as showing that the good these birds do in clearing out Wireworm is by no means of an unmixed kind. There is no doubt, either in the Isle of Man or elsewhere, that Rooks clear Wireworm and other larvae, but still where soil, state of crop, or want of food are such that the Rooks grub up and destroy the plants bodily it is matter for thought whether their numbers should not be lessened, or at least boys employed to frighten them off the crop during the few days after thinning, in which their work often does much more harm than good.

The following communication is also from the Isle of Man, but being at some length did not admit of tabulating:—

GLENDUFF, LEZAYRE.—No injury of any great importance has been caused by Wireworm this season. The crops most affected are those grown after green crops, and upon stubble; the previous crops to the injured ones were Summer Fallows, Potatoes, Turnips, and Wheat out of ley, but corn on ley, which was on heavy clay soil, has been almost free from injury, and uninjured crops followed sown seeds and young pasture.

The soil is fairly good, sharp, gravelly loam, intermingled by runs of white clay and peat. That which is most affected is light, open, sandy loam and dry peat.

The land was well dressed with farm-yard manure and bone superphosphate; very little lime, about one ton per acre in a five-course shift; no seaweed used.

Seed sown—of the injured crops generally in March and April, of the uninjured from November to Christmas. State of weather—wet in autumn and over dry in spring.

We are greatly troubled by Rooks and Larks, and they generally are the first to draw attention to the damage. It is impossible to detect the damage till some time after the Wireworm has been at work, then, though the young corn may appear healthy, the heart or central shoot will be found turning slightly yellow, and if pulled easily comes away.

Various measures of prevention are advocated, as hard rolling, gas-lime sown at the same time as the seed, or a top dressing of soot, salt, or superphosphate when the young corn is able to stand an after-rolling. All these methods will no doubt tend to counteract injury from the Wireworm by increasing the crop, but I do not think that they in any way destroy the Wireworm.

I am of opinion that when frost sets in the Wireworm goes down, and returns again when the weather changes. I have noticed when

ISLE OF MAN.

Parish of Observer.	Crop Injured and Nature of Crop preceding.	Nature of Soil.	Manure and Preparation of Land.	Date of Sowing and Weather at Time.
Leyzayre ..	Oats and Wheat slightly injured. Previous crops, Grass and Turnips.	Wireworm most active on light soils.	Lime in a quick state laid on lea destroys the larvæ.	... ..
	Some injury to Wheat and Oats. Previous crops, Grass and Green crops.	Gravelly loam.	.. ..	Spring sown crops suffered most. Ordinary weather.
	No injury	Turf and light and hilly soil. Loose soil more subject to attack.	Lime, farm-yard, and patent manure.	Wheat, end of Dec.; Oats, March; Barley, April; Green crops, May and June.
	1. Oats after Green crop much injured; 2, Lea Oats not touched.	1. Light soil on hill. 2. Rather strong earthy soil on lowland.	1. Only patent and limed in lea. 2. Patent and farm-yard.	1. Latter end of March (pretty dry). 2. 5th of April.
Kirk Bride I.	No loss through attack.	Light soil ..	No difference in preparation between injured and uninjured.	Wheat in Nov., weather dry. Uninjured crop in Jan., weather dry.

trimming Turnips, say the evening before frost, that Wireworm could be noticed in hundreds about the roots of the Turnips. A frost sets in, and if you pull up the whole field you will not find a Wireworm where yesterday there were scores ; but the weather changes, and our friend re-appears.

The injury from Wireworm has been less this year than almost any season I can recollect. I do not estimate my own loss, or that in the immediate neighbourhood or the parish, at more than half-a-bushel per acre.

The above remarks apply entirely to this district, as other localities may very likely be affected in an entirely different manner.—(James McWhannell.)

(The main points of the information with which I have been favoured by other contributors is embodied in the following tables.—E.D.)

TABLE I.

Observations regarding Rooks.	Remedies made use of.	Amount of Loss to Observer, or in his neighbourhood.	Injury more or less than in previous Years?	REMARKS.
Rooks always haunt crops infested by Wireworm.	... . .	... . .	... . .	Injury from Wireworm has much increased of late years; partly from prejudice against rooks and wholesale poisoning of these birds; partly on account of farmers not having limed to any extent of late years, owing to agricultural depression and general want of means.
Not so much troubled by Rooks this year.	Rolling and sowing salt.	Observer's loss about 2 bolls per acre, not aware of loss in neighbourhood.	Less this year than usual.	
Always a great pest here, but do not take Turnips till they are singled.	Salt and rolling would as a rule prevent attack if in time.	... . .	Less	If Rooks are kept away for two or three days after the Turnips are singled out they will not touch the crop after.
Rooks numerous where the Wireworms were seen; not observed on the low field.	Salt sometimes used. Consider it does not destroy the worm, but feeds the crop.	Observer's loss about a boll to the acre; not seen any crop spoiled in neighbourhood.	About the same as last year.	
Rooks on crop when 2 or 3 inches high. Injury about a month after.	Sowing salt and rolling for Wheat.	None this year. Previously severe in Wheat and Carrots.	Less. In previous year Wheat £1 10s. per acre. Carrots £10 per acre.	I consider Wheat sown in November as generally exempt from destruction by Wireworm.

Parish of Observer.	Crop Injured and Nature of Crop preceding.	Nature of Soil.	Manure and Preparation of Land.	Date of Sowing and Weather at Time.
Kirk Bride II.	Turnips have suffered; previous crop Barley.	Loose and sandy.	We use seaweed and farm manure.	June . . .
	Potatoes slightly after lea.	Light loam on sandy bottom.	Farm manure.	Planted in heavy rain in April.
Kirk Andreas I. II.	No loss. Barley after Potatoes, Turnips after lea.	Black soil ..	Yard manure.	Barley, May 18. Green crop about middle of June.
	No loss. . . .	Black soil, loam	Farm and patent, or patent only. No difference seen in work of Wireworm.	Wheat, Dee.; Oats, April; Barley, May; Turnips, June.
Jurbey I. . . II. III.	Carrots and Barley. Potatoes badly injured.	Sandy soil on gravel.	Farm-yard manure and dissolved bones. No lime.	Carrots and Potatoes planted about middle of April. Weather fine, soil moist.
	None at Thie Vane. Turnips after Oats on old lea at B'Managh badly attacked.	Sandy and gravelly; higher and most gravelly least attacked.	Dublin and Wicklow patent manure. Hollow with soil more earthy most attacked.	Injured crop end of May. Weather dry, but soil nice and moist.
	No injury . . .	Light land on gravel.	Farm-yard and patent. No lime. Wireworm are worst in light, turfy soil.	Lea Wheat, Dee.; Barley, March; Oats, April; Green crops, beginning of June.
Ballaugh I. II. III.	Small amount of injury to Turnips only.	Black sand in the Curragh.	Lime, manure, and dissolved bones. Crops on dung unharmed.	Seed sown in May and June. Weather fine.
	About $\frac{1}{4}$ Wheat and $\frac{1}{8}$ Turnips injured. Wheat after Green crops. Turnips after Oats.	Stiff loam, nearly marl.	Lime not been used for many years.	Wheat, 1st week in Jan.; Turnips, end of May, injured and uninjured same time; both in fine mild weather.
	No injury . . .	Wireworm cuts worst in turfy soil. Wheat suffers most in this neighbourhood.	. . .	. . .

Observations regarding Rooks.	Remedies made use of.	Amount of Loss to Observer, or in his neighbourhood.	Injury more or less than in previous Years?	REMARKS.
Do much harm to the Turnips, but no doubt in trying to get at the grub.	... ..	... ..	Less. Suppose the season makes a difference.	The "cut worm" is more in heavier clay soils. The Rooks come when the Turnips are singled, because they can get at them.
Rooks never affect my crops, though seen about.	None tried ..	At one locality one-eighth crop of Oats.	Less	Most damage to Oats in May, to Potatoes during autumn. Magnum Bonum slightly attacked. "Skerries" on some land sound.
Not much seen. Did a little harm by taking Potatoes.	A little salt and rolling.	Do not know of any.	Less	There were frequent showers in spring to bring on and strengthen the plant.
Seldom on the land this year.	None used, because Wireworm attack is never bad.	None noticed.	Less than in some years.	
Did not see the Rooks where the Wireworm was.	None; been here only 3 years, and never had much attack before.	Not much. Half crop of Carrots lost.	More on this farm.	Did not have Wireworm for fifteen years at Ballis Maughold. Soil more loamy and stony on the hill.
Rooks swarming on the part where the Wireworm was before we thinned.	None tried. Never suffered to such an extent before	Turnips in the neighbourhood suffered a little.	More on my land.	At Thie Vane the soil is in part rather heavy, in part rather sandy and peaty. The Wireworms are not found there.
Just when Wheat is peeping in bruit they do harm by pulling it up.	Liquid manure. Have tried this 8 or 10 years, and never found it fail to kill the Wireworm.	Crops not suffered on the whole.	Less than usual. When crops are earlier than usual worm does less harm.	Have found a good method to keep off Rooks to run a reel of cotton all round hedge of field, and across field just above corn.
Rooks are always on the crops when the worm is in them.	Have tried salt, which I think the best remedy	... ..	... ..
Rooks injured Turnips much both before and after thinning.	Have used gas-lime with advantage.	About 2 bolls (per acre) Wheat; $1\frac{1}{2}$ ton Turnips. About same loss in some neighbouring farms.	Injury much less than in some former years.	Have observed Wireworm do less injury after a soft mild winter than after a hard frosty one.
Have seen Rooks pull up the plant after being thinned and pick out the worm.	Rolling Wheat early in spring is best. Have tried salt with little effect.	This neighbourhood has suffered very little.	... ..

Parish of Observer.	Crop Injured and Nature of Crop preceding.	Nature of Soil.	Manure and Preparation of Land.	Date of Sowing and Weather at Time.
Ballauge .. IV.	No injury ... ..	... ..	... ..	... ..
	V.* Wheat crop out of lea suffered.	Soil inclining to gravelly.	Land limed the year before.	Wheat about the middle of December.
	VI. Turnips suffered slightly.	Sandy	Seaweed put under Potatoes (not for Turnips).	Turnips sown about end of May.
	VII. No injury ... ..	... ..	Last year Turnip crop a comparative failure where patent manure only was used.	Wheat from beginning of Dec. Weather favourable.
	Kirk Michael. I.	Very little, if any.	... ..	... ..
	II. No money loss, but some Turnips pulled up by rooks (after Oats).	Light and sandy soil. No Turnips noticed pulled up on heavier land.	Patent bone-dust manure, no farm-yard manure, and on heavier land farm-yard manure.	Injured about 2nd week in June, uninjured about 25th May.
	III. Potatoes after Barley.	Light mould, blackish loam.	Extra crop of seaweed on it, and ploughed under farm manure heavy.	Planted about 5th of April in fine weather.
German ..	No injury ... ..	... ..	... ..	... ..
Patrick I. ..	No injury	Soil dry	Land prepared in time with lime, seaweed, and farm manure.	... ..
	II. Very little	Heavy soil ..	... ..	... ..
	III. Immaterial ... ..	... ..	... ..	... ..

* Of a 7-acre field observed, of which 3 acres were treated with farm manure; a portion with patent and had the

Observations regarding Rooks.	Remedies made use of.	Amount of Loss to Observer, or in his neighbourhood.	Injury more or less than in previous Years?	REMARKS.
No injury by Rooks this season.	Soot and rolling the ground early in the morning when the dew is on.	Not aware of any loss this season.	... ...
Rooks are sure to appear where there is Wireworm, but not much elsewhere.	... ...	About $\frac{1}{2}$ of the portion of the crop affected.	Less than in former years.	Part of the field was dressed with seaweed for the green crop previous to the field becoming lea; that part was uninjured.
Rooks and Jack-daws come occasionally. Do little, if any harm.	Have found soot serviceable in garden cultivation.	Turnips slightly attacked.	Less. As good a season, free from cutting, as I think we ever had.	
Rooks always appear on the crop about the same time as the Wireworm injury.	Sufficient rolling is, I think, the best remedy.	Some injury to Turnips, amount not known.	Very much less.	The best remedy I know of and have tried is rolling; but the general impression here is that salt sown in with the seed or some time previous is very good.
Rooks on the land within a few days after thinning.	None	No money loss to observer, very trifling to neighbours.	Should say less.	No injury to corn has come under my notice.
When Wheat is just in bruit they come for the grain, not the grub.	None	Trifling	Not more than average.	"Skerries" the worst attacked. Potatoes sometimes destroyed in the spring, but most damaged in August.
Our crops have many times suffered injury from Rooks.	... ..	We hardly ever suffer from Wireworm in this neighbourhood.	... ..	This year the Rooks have destroyed most of our Potatoes, and many a year they have destroyed acres of our Turnips.
Rooks did much injury to Turnip crop before I had means of preventing them	... ..	No damage of any consequence, excepting to Turnips by rooks.	... ..	No injury to my Turnip crops by Wireworm within the last forty years.
Rooks are the greatest pests. Even Turnips larger than an egg I have seen pulled by them.	Salt ... . . .	... ..	Very much less.	Rooks possibly often on the look out for Wireworm, but have not noticed the following crop the least affected, even on the spot most attacked by rooks.

manure, and about 2 acres with patent manure and dirty salt, this last portion was free from Wireworm and fly, best Barley.

Parish of Observer.	Crop Injured and Nature of Crop preceding.	Nature of Soil.	Manure and Preparation of Land.	Date of Sowing and Weather at Time.
Santon ..	No injury this year.	Have found peat soil most liable to Wireworm.	Sowed this year with the drill, and did not do so formerly.	... ..
Braddan .. I.	Slight to Oats sown in ley field.	Sandy ... ..	... ..	17th March.
	No injury. Land previously pasture; Turnips and Potatoes.	Good brown earth. Sub-soil shale or rotten stone. Light or shallow spots attacked first.	Mostly use town and farm manure mixed.	Oats 20th to end of March. Barley about the middle of April. Weather dry.
Onchan ..	Much less than usual.	Find Wireworm most troublesome on light land.	... ..	In March. Weather dry.
Lonan ..	No injury this year.	... ..	... ..	... ..
Maughold I.	Injury to Potatoes, Turnips, and Oats, about a quarter.	Light, stony, sharp, soil.	Farm-yard and patent for green crop.	Oats about 16th March. Green crops 8th and 10th May.
	Oats after Grass, and Swedes after Wheat, slightly injured.	Peat	Limed six years ago. Swedes manured with 3 cwt. super-phosphate and 3 cwt. kainite.	Oats 18th March. Swedes first week in June.
	No injury to crops. Turnips after Oats, Barley after Potatoes, Oats on ley.	Partly loam, clay, and gravelly soil.	Barley well limed. Turnips on patent manure.	... ..
	Turnips half crop; Potatoes bad; Barley rather bad; Oats slight attack.	Peat and clay. No difference as to amount of attack.	Well limed for Turnips and Potatoes. Patent manure as top dressing.	Injured and uninjured sown about same time. Weather wet.
	Very little. Turnips, previous crop Oats, which were very badly attacked.	Light soil. With us peat on the hills is clearest from the worm.	Both farm and patent and some seaweed in the field, which was not injured.	Uninjured in May, injured about the beginning of June.

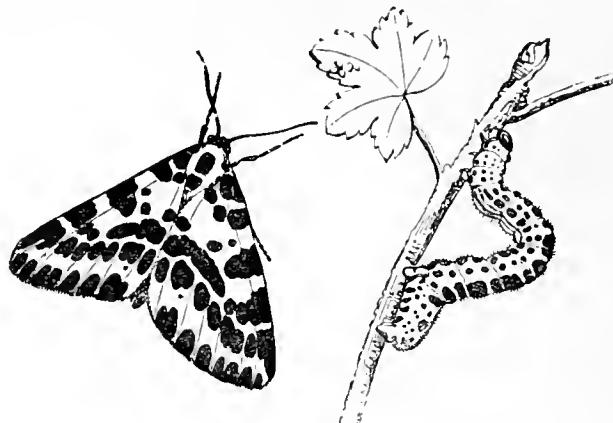
TABLE IV.]

WIREWORM AND CLICK BEETLE.

Observations regarding Rooks.	Remedies made use of.	Amount of Loss to Observer, or in his neighbourhood.	Injury more or less than in previous Years?	REMARKS.
... ... Rooks on the crops at sowing time. Some years Rooks do great injury by pulling Turnips to get at Wireworms.	Have found soot and gas-lime the best remedy No remedy tried. Guano sowed on a wet day been found effectual in attack on light hill soil.	In the neighbourhood Wheat suffered sown on clay land which had lain in grass. Very slight injury in neighbourhood. Oats after pasture crop chiefly injured in the neighbourhood.	... ... Less Less ... ... ...	... ...... ...
Observed on Oats newly sown and Turnips fresh thinned.	Have tried gas-lime with very satisfactory results.	Turnips and Lea Oats suffered much.	Fewer complaints of Wireworm this year than usual.	... ...
... ... Would have been about, but kept them away all the time.	... ... Have tried salt and tobacco by way of experiment, and found the latter kill the worm.	No attack known of. On B'corteen about half Turnips. I have about six tons Turnips where should be 15.	... ... Less than last year, when Wireworm loss was half the crop.	... ... There was a previous Green crop to half the Oats : the rest on land broken for the first time. The former was the worst attacked.
Rooks observed on neighbouring land just after Swedes were thinned.	Do not know of any remedy.	Two acres of Swedes almost destroyed.	Injury rather greater this year.	I think that as farmers now leave their land longer in grass this may account for increased destruction by Wireworm. They have time to increase, and birds do not readily get at them.
... ...	Have tried salt and nitrate of soda, but not been successful.	Do not know of loss in this neighbourhood.	... ...
Rooks on the crop when quite young.	Salt and soot with varying success.	About £25 to self.	Greater than usual.	
Some years are very mischievous; they come just after singeing and go right where the worm is.	Salt and rolling whilst crop is in bruit. Lime sown before ploughing.	... ...	Very much less this year.	Believe the worms work most in dry weather. Have seen gas-lime used with good effect, not a Wireworm after it.

GOOSEBERRIES.

Magpie Moth. *Abraxas Grossulariata*, Steph.



ABRAXAS GROSSULARIATA.

Moth and Caterpillar.

Mr. W. Ward, writing from Stoke Edith Gardens, Herefordshire, mentions the caterpillar of the Gooseberry or Magpie Moth as one that is very troublesome in June and July, but that he has not had much attack after the dressings of hot lime and soot given to clear sawfly caterpillar from the bushes. (See Gooseberry Sawfly).

Mr. W. Taylor mentions the caterpillars of the Magpie Moth as being certainly not numerous in the neighbourhood of Longleat; and crossing from Wilts to Essex, Mr. Shipman mentions from West Ham that the Magpie Moths seen in 1880 were destroyed; little harm was done by the caterpillars in 1881, and in this year, 1882, not one was to be seen.

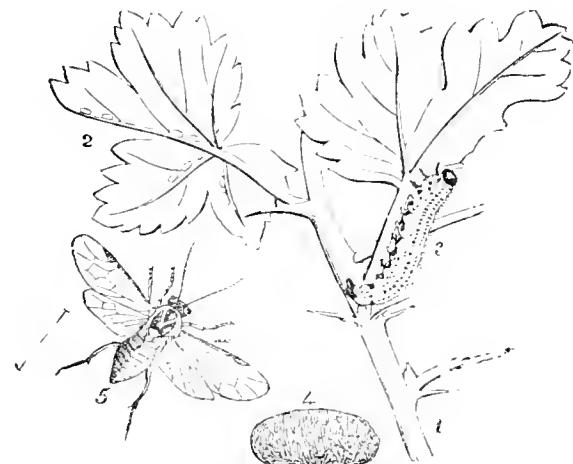
Gooseberry and Currant Sawfly. *Nematus ribesii*, Curtis.

The first two communications draw attention to the serviceableness of hellebore applied in a fluid state by means of a watering-pot, or as a spray, for destruction of the caterpillars.

Mr J. Busfeild, of Ripon, mentions having good success in clearing attack of the caterpillars from his Gooseberry bushes, by using a decoction of hellebore, so that it should fall as spray on the infested leaves. A large white-washing brush was dipped in the fluid and shaken nearly dry, and then so jerked against the branches as to send a good covering of spray well up beneath the leaves, which by this means were entirely cleared of the plague.

Mr. Geo. Brown, writing from Watten Mains, Caithness, says:—“Gooseberry Sawfly has been a source of annoyance to all gardeners in the north this season. Our bushes have literally been covered

with them, so that strong measures had to be resorted to. Quicklime was tried, but hellebore, although the more dangerous remedy, proved the most effectual ; but we think it a mistake to dust the bushes, as it was noticed after the operation that a great number escaped, which would not have been the case if the hellebore had been infused in hot water, and applied to the bushes by means of the common watering-pot."



NEMATUS RIBESII.

Gooseberry Sawfly, caterpillar, and earth-cocoon.

Mr. James Kay, Rothesay, remarks that the Gooseberry Sawfly caterpillar appeared very slightly this year. He notes having given a watering of paraffin early in the spring, to the stems of the bushes and the ground beneath them.

Caterpillars are noticed by Mr. McDonald as unusually numerous at Balfour Castle Gardens, Orkney, N. B., upon Red and White Currants and Gooseberry bushes. Dusting with hellebore powder when the bushes are wet is noted as a speedy remedy.

Mr. W. Ward, writing from the Gardens, Stoke Edith, Hereford, mentions that in the spring of the present year (1882) he watched very closely for the first appearance of the Gooseberry Sawfly caterpillar, and found four trees suddenly attacked by this "pest." The four trees were immediately well syringed and shaken, the caterpillars dropping on to the soil, where they were treated with burning hot lime. All the other Gooseberry and Currant trees were dusted with hot lime and with soot, and there was no further trouble with caterpillars and a plentiful crop of Gooseberries and Currants. After the trees were cleared the soil was covered with the same materials—hot lime and soot.

Mr. Taylor adds a very useful hint as to a good way of mixing paraffin with water. He says—"The only safe method of applying this is with the syringe; when the paraffin and water are mixed,

discharge the syringe into the tub once,—then syringe once, and in this way he considers the application a safe insecticide.

Mr. Taylor, writing from Longleat, observes, that besides the common Gooseberry caterpillar, with which he is perfectly familiar, there is a smaller kind which appears a month or six weeks later. This lays its eggs, and the caterpillars also begin to feed at the edges of the leaves; commonly only about three are hatched on one leaf. Nevertheless, in some seasons they are as numerous as the common kind, which lays half a hundred or more on one leaf.

(The specimen of the small green Sawfly caterpillar forwarded corresponded with the description and figure of the rare kind, *Nematus consobrina*.—ED.)

Mr. Taylor mentions that the chrysalis of this variety does not winter in the ground, unless it is just under the surface close to a wall or other dry place; it prefers the nail-holes in a wall or holes in wood, but it sometimes remains on the bush itself. Fir-tree oil, at the rate of half a pint to three gallons of soft water, applied in a fine spray all over the bushes, is the remedy used, but found to be an expensive one, as it has to be applied each time of appearance of the caterpillars, whilst they are yet small, and taking the two varieties together there are three or four broods during the summer. Shifting the bushes to new ground, some distance from their previous position, will give freedom from the caterpillars for a season.

The importance of bringing about a separation, in whatever way may be most practicable, between the Gooseberry bushes and infested ground cannot be too strongly impressed. Sometimes the Gooseberry bushes can be moved from the earth; but commonly it answers best to remove the surface earth from beneath the Gooseberry bushes. In either case the work should be thoroughly done, and a marked instance of failure from only half completing the work occurred in the past season, near Isleworth.

In the course of the autumn of 1881 the surface soil was duly removed from under the rows of bushes in a portion of a Gooseberry ground, but I observed that *it was not taken away*. The soil lay for months in rows between the rows of Gooseberry bushes, and in due time the attack, which was plainly to be expected, came, and the leafage was fairly devastated by caterpillar.

It is much to be wished that the superintendents on Gooseberry farms should themselves examine the state of the soil for two or three inches deep (or rather deeper in light soils), under a bush or two that has been attacked, and when they have found the brown caterpillar cases (which may be known by their likeness to the figure), and look like small brown earth pellets, just open a few and show the greenish caterpillar within to their workers. If the fact could by any means

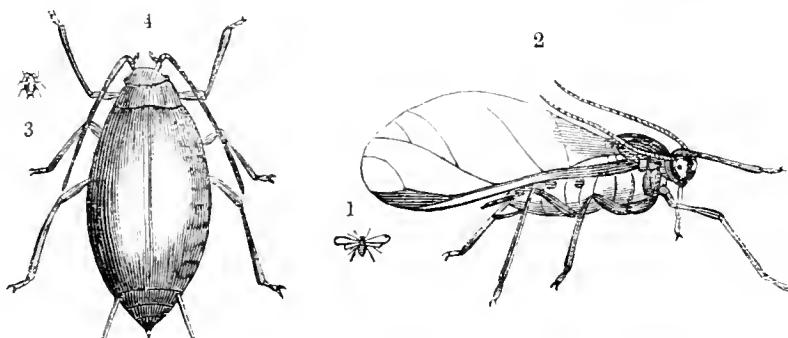
be impressed, that those caterpillars will live in their cases through the winter, and change to chrysalids and Sawflies in the spring, and, as surely as they are left under or by the bushes, the bushes will be infested again, it would be a great advance to getting rid of this loss which (in the complete face of knowledge of it being curable) is allowed yearly.

An observation was given me by a grower on a large scale, of these caterpillars having been seen in great numbers crossing a road which separated one ground from another. In cases of this sort, whether of Gooseberry caterpillar or other insects, which sometimes come on to the attack, plainly and visibly in large numbers crossing a definite space, the German plan of digging a ditch across their way might be made to answer as a method of prevention that would pay well.

If the ditch be filled with water to about half a foot below the ground level, and a boy set to see the creatures do not get out on the side they meant to travel to, this would do well; otherwise, shovelling on hot lime or gas lime, if at hand,—or if no other way occurred, setting a couple of boys to trample along the bottom of the ditch and destroy all that fell in,—would quite check the advance of the body.—ED.

H O P S.

Hop Aphid. *Aphis humuli*, Schrank.; *Phorodon humuli*, Schrank.



1 & 2, Winged female *Aphis*; 3 & 4, larvae or lice, nat. size and mag.

The attack of *Aphis* blight on the Hops during the past season has been the worst known for many years.

Mr. R. Cooke, writing from Detling, near Maidstone, mentions that the appearance of the blight was first talked about on the 16th of May, or a few days before, the attack beginning on the low river ground, from which it spread in all directions. On the 7th of June,

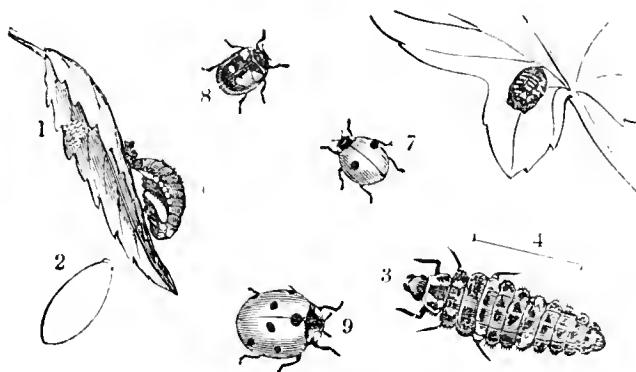
Mr. Hart noted from Kingsnorth, that great complaint was being made of the attack of Aphides on Hops, and on the 8th Mr. Whitehead mentioned, from Barming, that he had never seen the Aphis blight so prevalent; and observations were also made of the great quantities of Aphides on Apples, Plums, Damsons, Cherries, &c.

Mr. Turvill reported the appearance of the Fly near Alton, Hants, about the 20th of May, and by the 11th of June they were in masses on the Bines.

There was also in some places a scarcity of the natural check of the "Fly," namely, the Lady-birds and their grubs, known as "Niggers."* This was noticed specially in North Kent, where their scarcity, compared with other Hop districts, was remarkable; also by Prof. Fream, at the College of Agriculture, Downton, Wilts, on the 26th of June; and by Mr. A. Mannington, Northiam, Sussex, a few days previously.

As summer went on the published reports of the Hop districts in Kent, Sussex, Farnham, &c., showed for the most part the presence of "blight" in overwhelming quantities, together with the weak growth of the Bine from attack of the Aphis, and also from unfavourable weather. Want of sunshine, with low temperatures and sometimes cold nights, are reported again and again as accompanying

* The Lady-bird Beetle is well known everywhere, but its slaty or brownish six-legged grub, spotted with orange or scarlet, does not seem, from enquiries sent during the past season, to be as generally known as it ought to be; and as I have recently received a communication from Mr. Shipman, Forest Gate, mentioning that he found it was very often destroyed from want of knowledge of its useful habits in living on Aphides, or Green Fly, I add the following figures:—



LADY-BIRDS: 2, egg, mag.; 3 & 4, grub, mag., and line showing nat. size; 7, *Coccinella bipunctata*; 8, *C. dispar*; 9, *C. septem-punctata*.

These give a good idea of the grub, somewhat larger than life, and also of the chrysalis-case on the leaf; and these insects should *never* be destroyed, as the voracious appetite of the grub—and its strong jaws, by which it can nip hold of an Aphis, and shortly suck out its contents—makes this larva, as well as the Lady-bird, to which it presently turns, one of our best helpers, and often the only one we have in keeping down Aphis attack on Plums, Hops, Apples, &c.

the presence of hordes of the Blight; and these observations agree precisely with those of Mr. G. B. Buckton (our great authority on Aphides) as to the circumstances in which they multiply most rapidly. I give the passage, as it bears very practically on the method in which, where there is great amount of attack, the stinted pasturage causes the Fly to come to maturity sooner, consequently propagate sooner, and spread more quickly than even in its common rapid progress:—

“The addition of wings to the viviparous females obviously must much facilitate the spread of each species. This modification of form does not occur at fixed or stated intervals, but appears to be in some measure induced by an over-crowded state of the colony, and with a deficiency of food. Gardeners are well aware of the sickly and poisoned conditions produced in those plants which are subjected to the exhausting and irritating attacks of Aphides. When the nutritive juices of the infested plants begin to fail a change commences in the larvæ of those Aphides which are subsequently born. Swellings occur on the sides of the meso- and meta-thorax” [i. e., the sides of the two ring-like divisions next but one to the head (Ed.)], “within which the future wings are developed,” &c. Also, “I have repeatedly observed the effect of stinted food in hastening the development of wings.”—‘Brit. Aphides,’ by G. B. Buckton, vol. i., pp. 72, 73.

When once bad attack is established there does not appear to be any sure way of getting it under, but we might get hold beforehand, if we knew *how and where the pest passes the winter*. It is not known whether the female Aphis of the last autumn brood lays eggs then, and dies, or whether she lives sheltered through the winter and lays in the spring. I have in the course of the past late autumn and early part of the winter searched microscopically for eggs or the female under dead Hop leaves, and also on pieces of the Bine and pieces of stem, just above and below ground-level, without the slightest success. In earth, taken from the neighbourhood of hills or plant-centres in ground where the attack was very virulent, sent by Mr. Whitehead from Barming, I found a very few bodies, that might be portions of skins of eggs, but even if they were so it was impossible to say that they were Aphis eggs.

The only *certain* way to make out whether the Aphides come up from the earth about the Hop-root appears to be some form of the plan by which Prof. Riley watched and discovered a portion of the method of increase of the *Phylloxera*, namely, to raise a light wooden frame over a plant, fasten some material such as very stout muslin over it, which would admit light to the Hop, but at the same time secure that no insects get in or out, have a piece of glass fitted at some part of the frame to allow of looking in, and then *watch*. The

frame need not be very large, for it is only wanted in the early stages of growth. In this way it would be possible to make out quite *surely* whether attack occurred, and if so whether it was from wingless females, which had lived through the winter and laid eggs in the spring, or whether it was from the so-called lice coming up from eggs which had been laid in the ground.

We might, however, learn much (if not all) we need during the coming season, if those who have the opportunity would watch the bines on a few hills as soon as they begin to shoot, giving a careful look every day (or even every two or three days), so as to be able to learn without doubt whether, when the *very first* Aphides appear, they are in the form of "lice" (that is, wingless) or of "fly" (that is, winged).

If they *appear as lice* it would seem impossible that they can have come from anywhere but some shelter in or near the hill where they have been hatched; if they *appear as fly* we cannot but suppose they have come on the wing from elsewhere; for the "fly" must have fed in its previous state as "louse," and if it had done this at the roots in the hill it would have been seen before this time.

If the attack does not begin from eggs or Aphides in the ground around the stool of the Hop, the next question is, *What part Plum trees or the Sloe bushes play in the matter?*

It is distinctly stated by three well-known German naturalists that the Hop Aphid, the *Aphis humuli*, is to be found on Plums or Sloes. One (Kaltenbach) states that he himself has found it on Sloe bushes in May; another (Taschenberg) that it is found on Sloe, and therefore Sloe bushes ought not to be left near Hop grounds; and a third (Koch) states that *this Aphid* is to be found in May in great numbers on the young shoots and beneath the leaves of the Plum and Sloe, and that in the month of June these Aphides (that is the *A. humuli*) leave the Plum leaves and betake themselves to the Hop. This view was also taken by one of our own naturalists, Francis Walker, and it well deserves proving or disproving, for the notes given from our own Hop grounds of Hop Aphid being first observed in the winged state make it appear very likely that the creatures may have flown from some neighbouring feeding ground.

It is observed by Mr. Hart, of Kingsnorth, "It is generally considered that the Aphid first appears on the Hop in the winged form. The 'lice,' as they are termed, are never seen till after the 'fly' has appeared."

Mr. Whitehead also informs me that they are supposed always to appear first as *Flies*, but that he saw wingless Aphides in April last on the Hop plant, before the others were seen.

Mr. Turvill, also, writing from near Alton, mentions the appearance of "Mature Fly" about the 20th of May, and deposit following.

These points—namely, where they spend the winter, or whether they migrate—are what we need to *know*, in order to be able to forestall attack, and what can only be made out by watching the Hops.

Aphis attack has now been going on as a most serious trouble for more than ninety years, and will so continue until we gain more knowledge, but a little careful observation by many growers would most likely give all we need to teach us how to reach the enemy when at our mercy in winter quarters. I should gladly receive any notes that I may be favoured with on the subject, to be formed into a paper for publication, and I would with the greatest pleasure identify whether specimens sent were Hop Aphis, or give every information in my power.

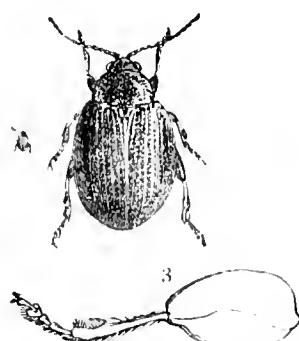
Hop Flea Beetle, *Psylliodes attenuatus*; and Hop Cone or Strig Maggot.

On April 22nd I received from Mr. T. H. Hart, Kingsnorth, Kent, specimens of the above-named Beetle, with the observation that this kind may be considered as "the" Hop Flea Beetle of the district, the damage caused by "tooth-legged" or "brassy" Flea Beetle being small in comparison. The observer notes that nine-tenths of many hundreds taken in Hop gardens have proved to be this species, but that at a distance from such gardens he has seldom found it.

The two kinds of Beetles are very much alike, both of them being brassy or bronze-green above, and about the size and shape of the common Turnip Flea Beetles, but under a magnifying-glass the *P. attenuatus* may be distinguished by the shank of the hind pair of legs having the foot inserted *a little way up* it (instead of at the lowest end), whilst the "tooth-legged" Flea Beetle has a tooth on the outer side of the shank of both of its two hinder pairs of legs (see fig.).

Where the *Psylliodes* propagate is not known, neither is it known what the little white maggot, which sometimes does a deal of harm by burrowing along the strig of the Hop cone, turns into; but if we can get a few observations, made about the beginning of September next, this point may be made out, and I conjecture we shall find the white

maggot to be the early stage of the *P. attenuatus*, which in such case we might perhaps more conveniently call the Hop Cone or Strig Beetle.



1 and 2, Tooth-legged Flea Beetle, *Chatoenema concinna*, nat. size and magnified ;
3, hind leg, magnified.

With regard to the habits of this maggot, Mr. Goodwin, writing from Cramond, Sevenoaks, mentions that attack from it has been very general in that neighbourhood, where the attack has ruined several pieces of Hops. He observes that it pierces into or rather is bred in the "strig" or stalk of the cone or flower, where it eats its way up the inside of the stalk, which causes the Hops to wither and turn brown. The maggots varied in number in one strig, but one or two were the average. In the earlier part of September these maggots were very numerous, but at the date of writing, September 27th, they had disappeared—"they drop out into the earth after eating the Hops."

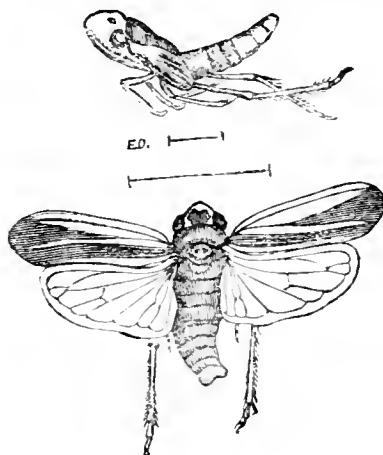
Specimens forwarded to me by Mr. Goodwin and from other localities, all showed the burrows of the maggots very plainly, but in all cases the maggot was absent, which confirms the observation of Mr. Goodwin and the conjectures of other observers, as to this grub leaving the Hop to change to the chrysalis and beetle in the earth.

Mr. R. Cooke forwarded specimens of Hops similarly attacked, from Detling, near Maidstone, mentioning that the altered colour was from the attack of a maggot, which channelled out a home for itself in the stem which forms the centre of the cone. The attacked Hops begin to go off from the tips, and the stem which supports the Hop dies back to the main branch. If in the next season some of the infested Hops were placed on earth in a flower-pot or box (tied over with a piece of stout muslin to prevent any escape), whatever beetle this maggot turned into might be secured when it came up from the earth and identified.

In the case of the maggots of *Psylliodes chrysoccephalus* (a nearly allied beetle), which I have observed tunnelling the flowering stems

of Turnips early in the year, these maggots only went down just below the surface and went through their changes, and reappeared as beetles in about a month.

Frog Fly; Cuckoo Fly; Jumper. *Eutacanthus interruptus*, Linn.



EUACANTHUS INTERRUPTUS.

Cuckoo Fly, winged and in early stage, magnified ; lines showing nat. size.

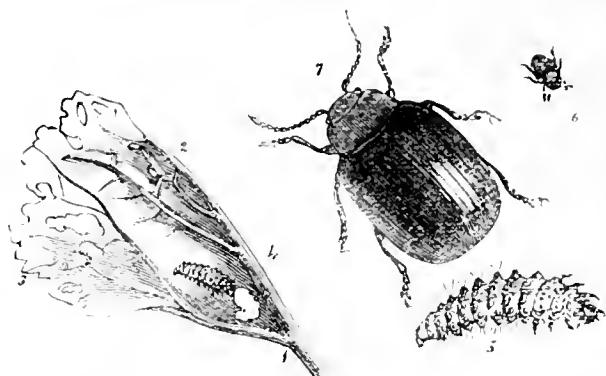
The only notes I have received throwing any light on the point of where the Cuckoo Flies, known also as Frog Flies or Jumpers, come out from to infest the Hop, are from Mr. D. Turvill, West Worldham, Alton, one of the neighbourhoods where these "jumpers" were particularly injurious in 1881.

Writing on the 11th of June he mentions—"I discovered the young 'Cuckoos' first this year in the base of the plants close to the ground, amongst what is known as the 'clearings,' or the superfluous vines that are neglected by the 'tyers,' and allowed to trail in a bunch around the roots of the plant—their appearing there first gives the idea of their emerging from the ground." Mr. Turvill mentions the Jumpers were not so prevalent as last season.

At Detling, near Maidstone, it is also noted that there was scarcely any attack this year.

MUSTARD.

Mustard Beetle. *Phædon betulae*, Linn.; *P. Cochleariae*, Fab.*



MUSTARD BEETLE, nat. size and mag. †

On June 6th I received the following note from Mr. C. Caswell, of Peterborough, regarding the Mustard Seed Beetle, with specimens accompanying:—Are you aware of the existence of a great pest in the shape of a beetle called by the farmer the Black Jack, that infests the Fen district between Peterborough and Ely, especially round Whittlesea? They feed upon White and Brown Mustard plants, Cress, Rape, or Cole, and are so destructive that in six or seven days they will completely destroy a field of twelve acres, and leave nothing but the bare stalks.

For the last two or three years the farmers have been afraid to sow White Mustard, of which the insect makes first choice. This was a most profitable crop, and hundreds of acres used to be grown in this district. The insect will live through the most severe winter in the pipe of the reeds and rushes in ditches and drains. Two or three years since they were so numerous that many acres of nearly ripe seed were burnt in the fields to destroy the beetle, but this was not effective, as they drop before the flame and bury themselves in the soil.

We have found the beetles alive in sacks of the seed for two years after it has been threshed.

Mr. William C. Little, of Stag's Holt, near March, mentions that for some years past immense damage has been done by the Mustard

* This beetle is sometimes injurious to Horse Radish, *Cochlearia Armoracia*, Linn.

† The beetle figured above, nat. size and magnified, is the *Phædon (Chrysomela) Betulae*, commonly known as the Mustard Beetle, and the larvae are of some species of *Chrysomela*, considered by John Curtis to be probably, but not quite certainly, those of *Betulae*. As I have not had any opportunity as yet of figuring the grubs myself, I give the good representation of John Curtis of the beetle with his further observation.

Beetle to crops of White and Brown Mustard, which are largely grown for seed in the district. On some farms the cultivation of these crops has been given up (at least for a time) because they were so infested with this plague. The chief damage is done either by the grubs, "the Black Jacks," or by the brood which is in full vigour in July. They seem at this season to eat out all the succulent part of the plant, and to leave only the woody fibre, and they so completely destroy the shell (*cosh*) of the seed-pod that the seed is shed and falls to the ground.

From a Mustard field they troop off to any neighbouring field where plants of the same tribe are to be found. They will completely devour a field of Rape if it is in a young stage, and a crop of Kohl Rabi, with bulbs as big as an orange, may sometimes be seen with the leaves eaten off by these insects, nothing but the rib of the leaf being left. At this period they seem to make little use of their wings. I have stopped their progress completely by burning damp straw in a gateway through which they were passing, but previously they fly vigorously. No attempts appear to be made to check the pest, excepting the above plan of occasionally burning straw or stubble to arrest their progress when moving from one crop to another, or burning the straw or haulm after the crop has been reaped, by which means the great numbers of beetles which had sheltered in the hollow stems of the plant are destroyed.

Mr. Little mentions that the Brown Mustard crop is not often seriously injured by this insect, as it ripens a little too early for the young brood, but the White Mustard, which is always a little later, is often completely destroyed. The best preventive of the ruin of the crop is considered to be sowing as early as is safe to secure good germination (and that the young plant shall not suffer from frost), and liberal manuring. The vigorous plant can thrive under an attack which would destroy a weakly one, and an early ripening diminishes the risk.

It appears from the notes of various observers that the Mustard Beetles live through the winter, and shelter themselves in different kinds of places, sometimes amongst the roots of grass, often in hollow stems of Mustard * or the pipes of reeds, and it appears likely that, just in the same way with the Turnip Flea Beetle, to which they are

* Mr. Little mentions—"Some years ago nearly all the Mustard straw was burnt when the crop was threshed, which was generally in the autumn, but now a good deal is saved to make rough sheltering walls for cattle, and the cottagers beg a few loads, and make use of it for covering their sheds or hovels." Looking at the fact of the beetles being known to shelter in Mustard straw in the winter, it appears well worth while to make out accurately whether they harbour in sufficient quantity in the old straw to make the loss on burning this less than what would be caused by the broods the wintered Beetles would start in the next spring.

nearly allied, they would be found during winter under anything that would protect them.

In the spring (it is stated by Kaltenbach) the beetle is to be found in damp places on brook lime and on the bitter cress, *Cardamine amara*, and the grubs are to be found feeding on the underside of the brook lime leaves. When full fed the grubs leave the plant and turn to chrysalids in the earth, but without spinning any kind of shelter for themselves, and the chrysalis state lasts only fourteen days. The beetles, of which a figure is given above, are of a bright blue or green, with the underside, horns, and feet black. Two broods of caterpillars have been observed, the first in May and June, the second in September.*

The only method at present found of real service in keeping down the multiplication of these beetles appears to be a change of crop, which may remove their chief food, but removal of the Mustard straw, and burning it instead of allowing it to be stored for shelters or rough roofing, is recommended, and burning all standing rubbish round fields as well.

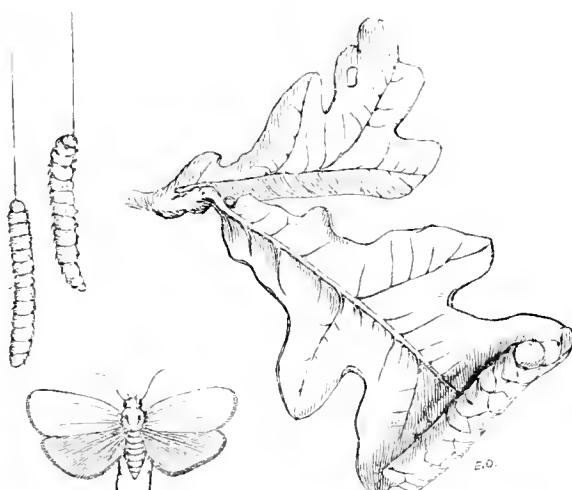
The methods of prevention noted will be observed to turn on the same principles as those brought forward in 1881 regarding prevention of Turnip Fly—namely, to clear out the pest by removing its food; to run the crop through moderate attack by vigorous growth; and also as far as possible to get it on so as to be at a different time to when the first burst of attack may be expected in full force.

No mention is made of any dressings such as are considered by many Turnip growers to be serviceable in checking attack having been tried whilst the Mustard is still young enough to allow of the application; nor of whether any caustic dressing, such as fresh gas-lime, is used to destroy the beetles that might be above or near the surface after a Mustard crop; nor yet of whether any clearing of the plants in or by the ditches, which afford shelter in winter and food in spring, as hollow reeds, water-cress, brook lime, bitter cress, shepherd's purse, &c., has ever been found practicable on a scale to be of service to the crops close by. Any information on these heads would be very acceptable for publication.

* See 'Die Pflanzen-feinde,' by J. H. Kaltenbach, p. 26.

OAK.

Leaf Roller Moth. *Tortrix viridana*, Stephens.



Moth; caterpillars hanging from their threads; and rolled leaf.

The Oak Leaf Roller Caterpillars are noticed by Mr. Robert Coupar as having caused much damage to the Oak foliage at Colenden, Perthshire, the attack being most severe to trees that either stood alone or on the outside of plantations, or by the side of drives. *

ONIONS.

Onion Fly. *Anthomyia ceparum*, Curtis; *A. antiqua*, Meig.

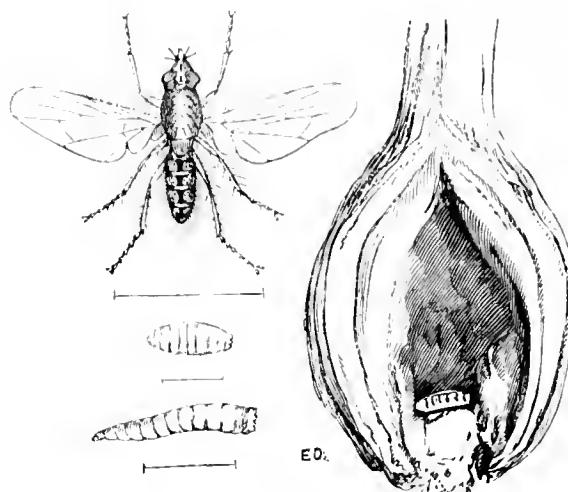
Leek or Shallot Fly. *Anthomyia platura*, Meigen.

The injury to Onion crops in this country has commonly been supposed to be caused by only one kind of fly; but in the course of 1882, specimens of Maggots infesting Onions in different parts of the country having been submitted to Mr. R. H. Meade, of Bradford, he reared from these another species of Onion Fly, the *Anthomyia platura* of Meigen, sometimes known on the Continent as the Shallot Fly, besides the well-known *A. ceparum*, or, as it appears now more generally called scientifically, the *A. antiqua*.

These small two-winged blackish and grey flies are much alike in appearance, but for practical purposes it may turn out of great service to know there are two sorts, as they do not seem to be quite alike in their habits.

* Leaf Rollers were also injurious to the Sycamores, or Planes, as they are sometimes called in North Britain.

With regard to egg-laying, the *A. ceparum* (supposed to be specially the Onion Fly) has been stated by various writers to lay its eggs on the leafage, from which eggs the maggots eat their way down into the bulb; but from observations made in my own garden I found attack



Onion Fly, pupa, and maggot, all magnified. Onion bulb, showing pupa remaining in stored Onion.

was generally begun, not in this way, but from eggs laid either quite at the base of the bulb or at the lower part of the side. I submitted specimens of the Maggots infesting these Onions to Mr. Meade, and they proved to be not of *A. ceparum*, but of *A. platura* (more conveniently called the Shallot Fly).

This difference in habit of the two kinds, if constant, is an important consideration in methods of dealing with the attack. In my own garden I had the bulbs of the Onions kept carefully covered with earth during their early growth, and they did not suffer from Maggot until about the 3rd of July, when some slight injury appeared, and I had the rows well earthed up by means of the hoe, and found this answer well; only a few of the Onions were destroyed, and though many were afterwards attacked the strength of the plant caused them to overgrow the injury, and I had little loss.

Earlier in the year Mr. Malcolm Dunn forwarded specimens of Maggots, then attacking the Onions at Dalkeith, to Mr. Meade (whilst still young and as yet with hardly any bulb formed), and these were in due course found by Mr. Meade to be of both the *Anthomyia antiqua* and also of *Anthomyia platura*.

With regard to the method of attack Mr. Dunn says—"I have examined a good many specimens of Onions, and could discover neither eggs nor young grubs *above* the surface of the ground; but *immediately below* the surface the grubs are busily at work." Mr. Dunn also states that he is satisfied that these flies are attracted by putrid or decaying vegetable matter, and this point is a very important one. In the case

of the Shallot Fly Bouché found its Maggots by thousands in night soil, and we need to know more clearly whether by applying manure that attracts the Fly we increase attack of Maggots to the bulb, or whether, on the other hand, such applications may serve as a decoy to draw off the maggots.

In the course of last season I applied a thick dressing of what is known as "Indian" Rape-cake (that is, Mustard-cake), which smells almost intolerably whilst putrefying, and is in this stage very attractive to flies, and soon found it infested with Maggots, whilst the Onions did well.

The very different amount of attack to Onions and to Leeks is also worth considering. Some kinds of Onion Fly feed indifferently on either plant, and there does not appear to be any reason why the Leeks should not suffer as much as the Onions, excepting the difference in method of cultivation by which in earthing up the Leeks we protect the bulbs by a good solid coating of earth from the flies getting at them to lay their eggs. Two years' trial of the effect of earthing up Onions have made me think that this plan would save much loss wherever the Onions are sowed in drills, so as to admit of earthing by the hoe; where they are sown broadcast of course the plan is not practicable.

With regard to remedies for attack Mr. W. Taylor, Longleat, Warminster, mentions that last spring some of the Onions showed signs of flagging whilst still only about the diameter of a knitting-needle. Every Onion so affected was pulled up, carefully placed in a basket, and *carried straight to the stoke-hole fire*. The plants were treated in this manner every two or three days for three weeks, and the result was that there was no further damage during the summer, and the crop of Onions was the only good one in the neighbourhood.

Mr. Taylor notes that one of his garden men followed the plan so far as to pull up all the faulty Onions in his garden, but he threw them down *a short distance from the bed, and lost his entire crop.*

Mr. W. Ward, writing from The Gardens, Stoke Edith Park, Hereford, mentions that he has found quicklime and salt at the same rate of quantities to be of great service in keeping the "pests" away from Onions,—these used in the same way as pointed out for Carrots, see p. 12.

Mr. Malcolm Dunn, of Dalkeith, mentions that when he saw the first signs of attack on Onions he had them dressed with dry soot and lime, taking care that it was applied *close around the stems* of the plants. Two or three careful applications put an end to the attacks, and the crops scarcely suffered.

Mr. Grierson notices that on the first appearance of the Onion Fly on his crop at Torloisk, Isle of Mull, he had all the attacked Onions

carefully pulled up and *burnt*, and gave the break a good watering with paraffin oil and water, and repeated the pulling up and watering whenever the Maggot made its appearance, and saved a good crop.

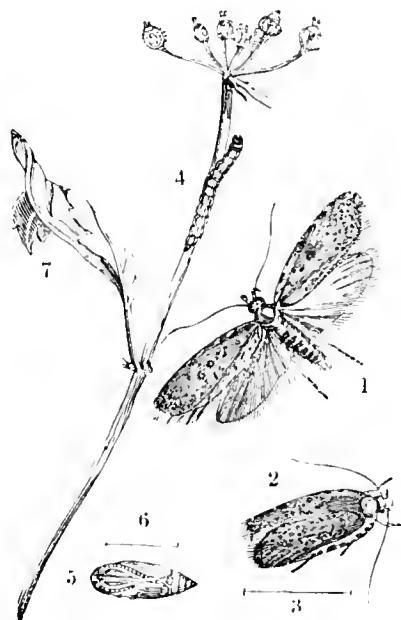
P A R S N I P .

Parsnip Seed Moth. *Depressaria Heracleana*, De Geer.

On the 21st of July I received from Mr. W. W. Glenny, of Barking, some heads of Parsnip Seed, webbed up by some small Moth Caterpillars then within them. These Caterpillars were from half to three-quarters of an inch long, of a greenish grey colour, dotted with small black warts above and orange colour below, and the heads black. Not being acquainted with the species, I submitted it to Professor Westwood, who reared the moth, and kindly informs me that it is the *Depressaria Heracleana*.

This is a small moth about an inch across in the spread of the fore wings, which are of a pale drab or greyish colour, marked with darker or black dashes, and the hind wings are pale gray.

The observations of various writers show that this moth very much resembles some of the other kinds of *Depressaria*, commonly known as



PARSNIP SEED MOTH. *Depressaria cicutella*.

Common Flat-body Moth, caterpillar and chrysalis; lines showing nat. size.

Carrot or Parsnip Seed Moths, both in appearance and in habits in the caterpillar state, but from it being more commonly found in this stage feeding on the flowers and unripe seeds of the common Hog-

weed, *Heracleum Sphondylium*, than those of the Parsnip, the special name of *Heracleana* has been given to it.

It appears from various writers that the *Depressaria* larvae are to be found in June and July, and when full fed leave the heads, and either change to chrysalids on the ground or bore into the stem of the plant and change within. The Moth appears during August and September, and the attack is considered to be started in the following spring from eggs laid by females which have lived through the winter.

This kind is mentioned by Kaltenbach as attacking Parsnips in Germany, but is not alluded to among the kinds specially named as injurious by John Curtis.

Mr. Glenny, when writing on the subject of prevention, observed--“The caterpillar on the Parsnip Seed is very easily disposed of, for if the heads of the plant are carefully separated, and the woven web destroyed by hand, the insect falls to the ground, and as the plant is at that stage of its growth about five feet in height the caterpillar cannot reach the summit again to do any mischief even if it wished.

As Parsnip Seed is generally grown in small areas, it is easier to deal with the caterpillar in this way than if large fields were taken up with its cultivation.”

In attacks of some of the other kinds of Parsnip Seed or Blossom Moth it has been advised just to shake the head; the caterpillar lets itself down by a thread on alarm, and if the work is thoroughly done, so that it cannot go back up the thread, or is kept, either by instinct, or by being trampled on, from going back up the stem, the method would answer well.

Many kinds of these “Flat-body Moths,” or *Depressaria*, feed in the caterpillar state in the heads of wild umbelliferous plants, such as chervil, cowbane, or water hemlock, hogweed, &c., and it would be likely to lessen amount of attack to the cultivated umbelliferous plants, namely, Carrots and Parsnips, if these great weeds, some of which are found in large patches, were destroyed.

For full account of the *D. Heracleana* see the paper on “Parsnip Seed Moth,” with an excellent and full illustration by Professor J. O. Westwood, in the ‘Gardener’s Chronicle’ for Nov. 18th, 1882, p. 652.

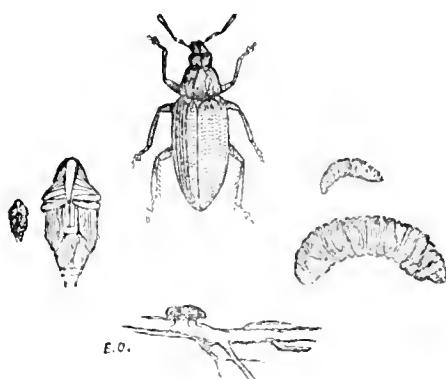
P E A S.

Pea Weevil, *Sitona lineata*, Linn.

The accompanying figure shows the Pea Weevil, *Sitona lineata*, in its three stages of maggot, chrysalis, and beetle, life size and magnified, drawn from specimens forwarded to me by Mr. T. H. Hart, of

Park Farm, Kingsnorth, Kent, together with information from observations taken by himself of the habits and history of this Weevil, which have so long been sought for previously without success.

Mr. Hart mentions that his attention having been directed to a Weevil grub having been found feeding on Clover roots, that he pro-



Pea Weevil, maggot and chrysalis, all nat. size and magnified.

ceeded to examine his Pea roots (not as before by loosening the soil and drawing the plant out of the ground, but by digging up the plant bodily, and carefully removing the earth), and soon found many Weevil grubs. This was on the 31st of May. Some of these grubs, or maggots, were lying along the main root, which bore marks of channels having been eaten along it, but, for the most part, the soft gall-like growths so often to be found on the fibres of Pea roots appeared to be their favourite food; some of the maggots were found within the galls, but only where there was such an opening as to give evident means for the passage of the grub to the inside. The maggots when full grown were of the size and shape figured above, white, plump, and wrinkled, with a brownish horny head, and pair of strong projecting jaws, legless, but using the end of the tail as a kind of foot to help them in progression. When full fed the maggot formed an oval cell (without a lining) in the earth about two inches below the surface, in which it changed immediately to the chrysalis state. In this stage it is like the perfect Weevil, only with the limbs folded beneath it—at first it is white, but as it matures the eyes become black and the proboscis pitchy. The Weevil when fully developed is black, and grey above, with three light stripes from the head to the wing-cases, and the wing-cases are marked with narrow stripes running along them of alternately lighter and darker tint. The Weevils from the maggots brought in from the field reached the perfect state by the 6th of July; those left in their natural position in the field did not develop until somewhat later.

All that we need now to complete the life-history of this Weevil

is the knowledge of when and where the eggs are laid; but as the Weevils have been observed when in confinement pairing and laying eggs rather earlier in the season than the time when the maggots were found feeding on the roots by Mr. Hart, it is presumable that when at large the females go down into the ground to deposit their eggs amongst these roots.

In the maggot state they do not, as far as we see, cause nearly so much harm to the roots as the Weevil does afterwards (when it is developed) to the leafage of the Peas. Then—though the damage is only too plain—the Weevils are not often noticeable unless the plants are approached exceedingly gently, for at the least alarm they drop down and hide themselves.

It is observed by Mr. Hart that if the soil in which the Pea Weevils are hidden is pressed firmly down with the foot for the space of some half-yard square that in a few seconds the place will appear alive with the Weevils, which will push their way to the surface. If, therefore, the weather admits of the free and repeated use of the roller a great proportion of the beetles may be crushed or rolled down so as to prevent them coming to the surface, and the plants being thus freed even for a time from attack, and helped afterwards by the use of the hoe, will be able to grow past the danger of being seriously injured.

With regard to estimate of damage, Mr. Hart mentions that whilst one stack from eight acres of Peas that were *not infested* contained twenty-two loads, the piece of six acres that *was infested* only produced eight loads, a load being as much as may be comfortably drawn by two horses in a four-wheeled waggon. Altogether the loss was estimated at not less than £20.

Mr. Russell Swanwick contributes the following note of injury caused by Pea Weevils at the Royal Agricultural College Farm, Cirencester. He says—The ravages of the Pea Weevil have this year been most serious. They not only attacked Peas, but also Vetches just as they got into their second leaf. Five acres of Peas sown February 23rd, and three acres sown a little later, were eaten to the extent of two-thirds, leaving only one-third of the plant to battle with the Weevil, and this remnant was so much eaten round the edge of the leaf as to be greatly weakened.

Another acre of valuable Garden Peas, which were being grown for seed, and were sown on March 15th, also had fully half the crop destroyed by this Weevil.

Two acres of Vetches were entirely eaten by them, and had to be ploughed up. Six more acres were badly injured.

The actual damage cannot be calculated from the loss of crop only, as to this must be added the damage from the growth of weeds

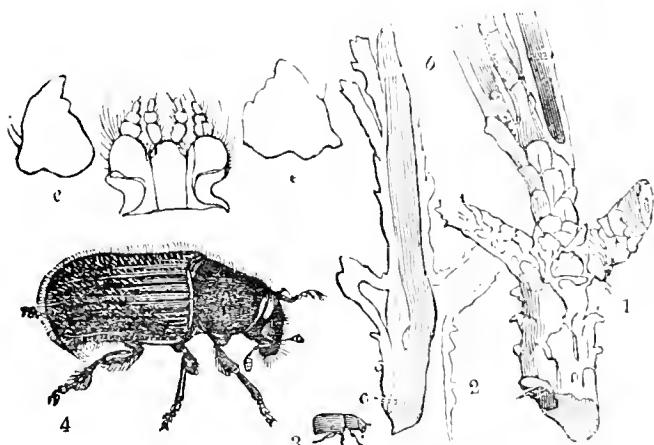
owing to the thinness of crop. There is no doubt the Weevils would not have done a quarter of the injury had it been a growing time, but the weather was cold, and the Peas could not get away. The loss on the nine acres of Peas cannot be put at less than £50, without reckoning the increased foulness of the land and loss of straw together probably £20 more. On the Vetch crop the damage was over £20.

For all from £90 to £100 loss must be laid to the score of this insect pest.

Professor Allen Harker, writing from the Royal Agricultural College on the subject of *Sitones* in the Peas and Vetches, mentions—"I have no doubt they hibernate, as individual specimens have occurred now and then since January."

PINE.

Pine Beetle. *Hylobius piniperda*, Curtis.



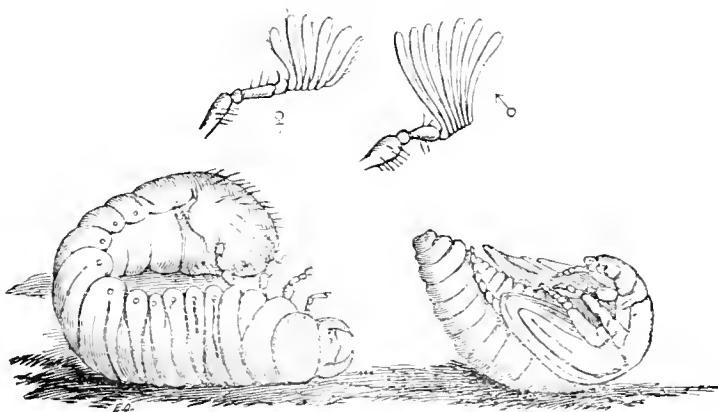
1 and 2, Pine shoots pierced by beetles ; 3, 4, Pine Beetle, nat. size and magnified ;
e e, jaws ; f g, chin, with feelers, &c., magnified.

Mr. Robert Coupar, Old Scone, N.B., remarks relatively to Pine Beetles having been observed laying their eggs in the bark of growing trees, that he has noticed this, but that in every instance which he observed the trees had fallen into a sickly state, and therefore were quite suitable for attack from the beetle. He remarks that although the beetles do not breed in trees too far gone in decay, yet that he has never met with quite robust and healthy trees being selected for egg-laying and breeding purposes, but the most healthy are attacked by the beetles for food, and in these they tunnel the young shoots. Mr. Coupar notes that in one young plantation where attack was bad he found many of the cones tunnelled.

The best methods of keeping off attack are noted (as before) to be

clearing off forest pine rubbish, so as to prevent egg-laying; and picking off the young shoots by hand when the beetles are seen working in them.

Cockchafer. *Melolontha vulgaris*, Stephens.



GRUB AND CHRYSALIS OF COCKCHAFER.

Club of the horn of male (♂) and female (♀) Cockchafers.

Any information as to measures that have been found serviceable in clearing Chafer grubs from plantations or other ground would be gladly received, as they are the cause of great loss in some of our Colonies as well as at home.

On the 20th of June I received information from Mr. T. J. Turnbull, agent to the Earl of Shaftesbury, relatively to the very serious injury caused by Cockchafer grubs to young seedling Fir. The grubs forwarded were of various stages, some apparently fully grown, and the young Firs, which were about 10 or 12 inches high, were being destroyed by the gnawing of these grubs removing the bark in large patches from the main root of the seedling Fir.

Mr. Turnbull mentions thousands of acres of the Fir plants having been destroyed by the grubs in the previous year, and that they appeared likely to do as much harm in the present season. "They did not seem to inhabit the black sandy soil, but made their home in the stronger clay loam."

No remedy appears to be known in cases like this excepting encouragement of rooks.

Mr. Malcolm Dunn, writing from Dalkeith, says—"We suffer very little in Scotland from the attack of the Cockchafer grub, and it seldom touches the roots of Pines with us. About 18 years ago, whilst I was living at Eardiston, in Worcestershire, we had a young Pine plantation, mostly Scots Fir, very badly injured by the grub of the common Cockchafer, which devoured the roots close to the collar, causing the trees to turn yellow, and many of them died. The

following year, 1865, the attack was not nearly so bad. We tried no remedy, but the rooks and insect-eating birds eagerly devoured the grubs wherever they found them."

In the case of turf infested by Cockchafers, Mr. James Forrester, Bryanston, Blandford, notes rolling as a useful application, as well as encouragement of rooks. He observes—"A large lawn of old turf became the haunt of rooks in April, but were scared, and the turf was soon yellow and nearly dead. On examination the Cockchafer Beetle was found to swarm, but by heavy rolling the turf was saved. Since that year the rooks have their full feast on the lawn in the spring, and it is evident that they clear the beetles, as the turf has been perfectly preserved.

In the 'Transactions' of the Entomological Society of Ontario, 1881, mention is made of moles proving very useful in clearing grubs of one of the Canadian Chafers, *Lachnostenus fusca*, from a piece of badly-infested Potato ground broken up from turf. Many of the Potatoes had been partly eaten by the grubs, but wherever a mole-run traversed a hill of Potatoes no grub was to be found, even though the half-eaten Potatoes were proof of his former presence.

Where the ground is without crop turning on pigs to follow the plough is a good plan, but it does not appear practicable at present to get rid of the grubs in occupied land by any dressing that will not hurt the crop. I have tried the Paris Green (experimentally) without finding any effect.

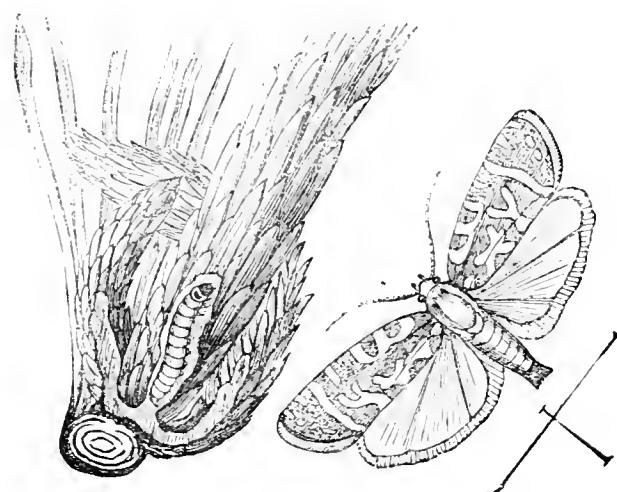
Where the ground is not occupied (and the materials are procurable) very heavy dressing with gas-lime in its fresh caustic state, or "chemical waste," which can be procured at little more than expense of carriage from alkali works, would be very desirable applications. The applications are equally destructive to everything they touch at first, and good manure, where gypsum is serviceable afterwards; but the fact of the "waste" being procurable for carting near the works has caused it to be much used in some localities as a destroyer of plant vermin and weeds.

Pine-bud Tortrix Moth. *Retinia turionana*, Hubn.

On the 15th of April Mr. Coupar forwarded to me some twigs of Scotch Pine, *Pinus sylvestris*, taken from a plantation nine or ten years old, with the note that the insect of which this contained pupæ did much harm in young Scotch Fir woods.

On examination I found that the shoots, or rather sprouting buds, were more or less coated at the base with turpentine, which flowed from the injuries caused by the caterpillar. In some instances most of the buds had perished, and the end of the shoot become little more

than a diseased mass of broken matter and turpentine, and in several cases one of the largest of the cluster of buds was completely cleared out, so that the bud would break off to a touch, coming away like a hollow cap.



Pine shoot injured by caterpillars of a Tortrix Moth ; Pine-bud Tortrix Moth, magnified ; line showing nat. size.*

Two brown chrysalids were still present, and in other buds, judging by their condition, the moth had only recently developed out of the chrysalis and left the hollow bud.

With regard to their history, Mr. Coupar says that the moths lay their eggs around and about the buds of young Pines in summer and autumn. After a time these hatch, and the caterpillars from them eat their way into the bud at its base—that is, into the bud which has been formed for the following year.

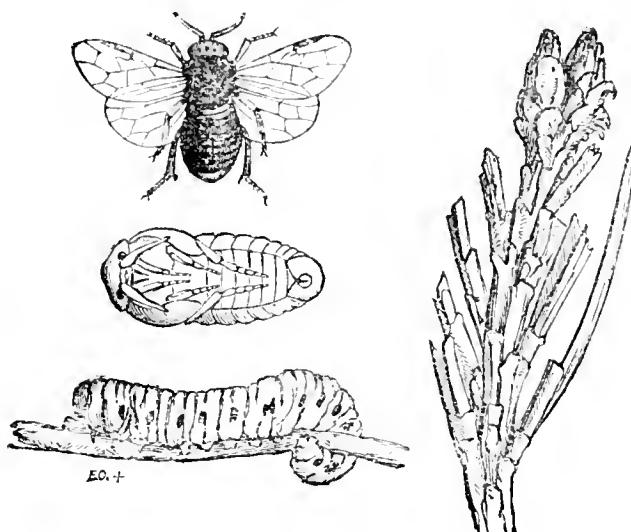
These caterpillars eat the whole inside from the bud, leaving nothing but a thin outside shell, and after they are full fed they turn to the chrysalis state within the bud they have thus hollowed out. From this the perfect moth comes out—in some cases seen by the observer—about the end of April or beginning of May, but in the present year some caterpillars were still unchanged towards the end of August.

It is noted that the damage caused by these caterpillars may easily be known by the straggling appearance and loss of the regularity of growth of the trees from the injury to the buds and leading

* The *R. turionana* has the fore-wings of a reddish or tawny orange, varied with silvery markings ; the hind wings a greyish tint ; and the above observations of the date of the first appearance of the Moth seen by Mr. Coupar (which was confirmed by the state of the specimens sent) and mention of the caterpillar being seen in August point to the development extending over a longer time than is noted in the German forest observations. The only remedy known appears to be to cut off and destroy buds or shoots which from their external appearance are seen to be infested.—ED.

shoots, and this species, the *Retinia turionana*, is considered by the observer to be as hurtful as the *R. buoliana*, as in each case the shoot is spoiled, by the first named in the bud, by the second during growth of the shoot.

Pine Sawfly. *Lophyrus pini*, Curtis.



Pine Sawfly, chrysalis, and caterpillar magnified : Pine leaves eaten by caterpillar.

It is noted by Mr. D. Scott that on a detached estate to the East of Forres there has been attack (for the fifth or sixth year in succession) from the Pine Sawfly. In the present season he tried the solution of soda and water mentioned at p. 44 of the Report for 1881, and found it was effective in clearing the caterpillar, but from the inconvenience of applying it in sufficient quantities he could not speak with certainty as to results.

He also observed (as he had done in the previous year) that a cold wet day or two were very effective in causing the caterpillars to disappear.

Mr. R. Coupar mentions that there was no attack of Pine Sawfly this year at Colenden, Perthshire, but that further to the North he had observed a young Pine plantation of about ten years old which had suffered from attack last year, and which had been again attacked so severely this year that the young trees were completely stripped of their foliage. The ground on which the plantation was formed had for a long time before lain uncultivated and covered with heath and bracken ferns.

The observer considers where the plantation is otherwise healthy and thriving that setting boys to hand-pick the grubs would be serviceable.

(Search in autumn or winter for cocoons lying in the ground at the roots of trees that have been seen to be infested during the previous season, could not fail to do good, for though the Sawfly may and does come on the wing from many places, and lay eggs on the trees to set up attack, it is very certain that the Sawflies which hatch in spring or summer from the chrysalids at the foot of the trees are most likely to attack the trees above them, and in the instances above mentioned the successive generations appear to have been doing this.—ED.)



Spruce Cone-gall Midge. *Cecidomyia* (? *albilabris*).

On February 10th two fine Cones of the common Spruce Fir were forwarded to me by Mr. Coupar from Colenden, near Perth, with the information that they were infested by a small Fly or Beetle, which caused a gall growth.

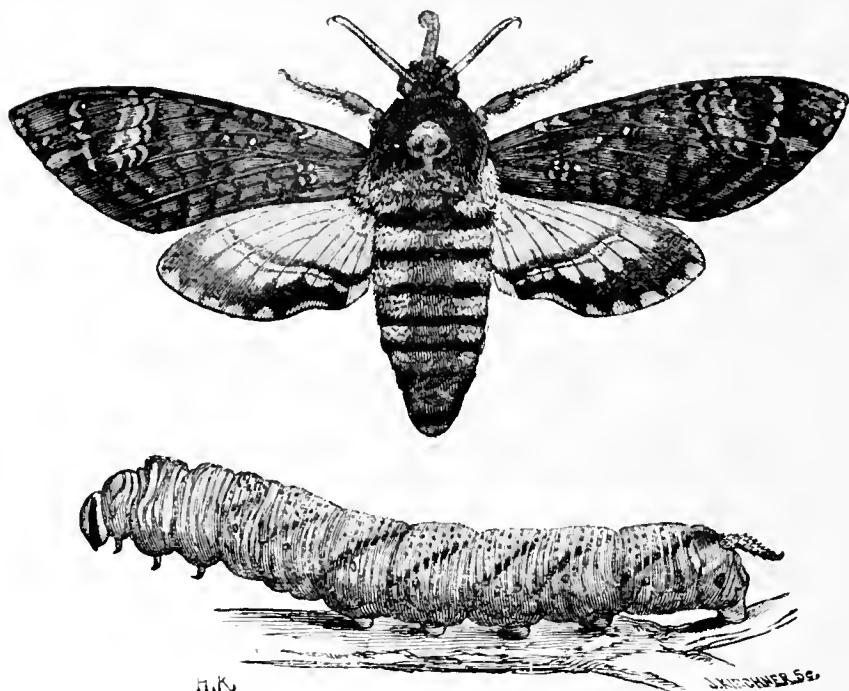
He observed that he thinks the insect pierces the Cone whilst it is still young and green to deposit its eggs, and when the Cone is matured in autumn that the fly is then in its larval or maggot state.

On examination a little gall growth containing a silken-lined cell was found at the base of several of the scales of the Cone, and on submitting a Cone to Mr. R. H. Meade he found in one of the galls the pupa or chrysalis of a *Cecidomyia* (a small midge or gnat-like fly), much resembling the perfect gnat in shape, with its imperfectly-formed wings and its legs folded under it. During the summer *Cecidomyia* hatched from the Cone I kept, which Mr. Meade believed to be *Cecidomyia albilabris*, but from my specimens having been injured before I could send them, he could not speak with certainty.

It will be of interest to complete this observation of the Cone-gall forming Midge next year; the figure of the Wheat Midge (p. 19) gives a general idea of its appearance.

P O T A T O.

Death's Head Moth. *Sphinx atropos*, Linn.



Death's Head Moth and caterpillar.

On October 10th a specimen of this splendid moth was captured by Mr. J. L. Sinclair, at Stanger Gill, near Thurso. The caterpillar feeds mainly on Potato leaves, but rarely occurs in sufficient numbers to cause serious damage.

T U R N I P.

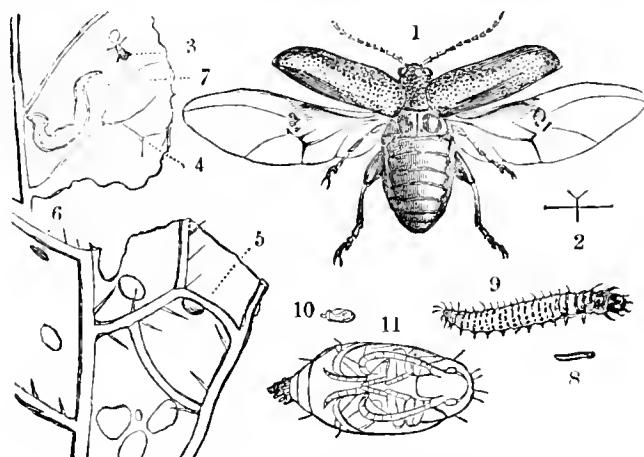
Turnip Fly, *Phyllotreta nemorum* : *Phyllotreta undulata*.

During the past season injury from Turnip Fly has been scarcely noticed by any contributors, and the following notes of absence of attack in some places, and from others of appearance of the "Fly," but of its increase and ravages being checked by moist weather suitable for Turnip growth, pushing on the plant into the rough leaf, are of much interest to compare with the precisely contrary state of affairs in 1881.

Professor Fream, writing from the College of Agriculture, Downton, on June 26th, mentioned that early sowings of Turnips and

Swedes had quite escaped the Fly, owing to the somewhat too copious rains which fell in that locality.

At W. Worldham, Alton, Hants, Mr. Turvill mentions that he "found the ubiquitous little fellow, together with his cousin, the



TURNIP FLY. *Phyllotreta nemorum*.

1—3, *P. nemorum*; 4 and 5, eggs; 6—9, maggot; 10 and 11, pupa; all nat. size and magnified.

'brassy,' snugly ensconced in the hollow stems of both hops and nettles, but the opportune showers effectually disposed of all danger as to Turnip Fly for the season."

Mr. Hart, Kingsnorth, Kent, mentions that, as might be expected from the abundance of Turnip Flea last year, it was very plentiful and troublesome in the early part of this season, and some first sowings were lost in the neighbourhood of Kingsnorth, but circumstances were apparently not favourable for its increase, and by the time that Swedes were up it had become quite scarce.

Turnips were therefore good, and at the sheep fairs lambs were from 10s. to 12s. each dearer than last year, which was to a great extent owing to there being a good supply of winter food.

Mr. R. Cooke mentions that at Detling, near Maidstone, this gave little or no trouble.

Going further north along the Eastern Counties, Mr. E. A. Fitch observes that in Essex throughout Dengie Hundred he should think there never was a better plant known of anything excepting Clover.

The Rev. J. H. White, writing from Weybread, Suffolk--a parish which suffered very severely in 1881 from Turnip Fly--mentions that the crops have been very free from insect injury, and there has been no attack of "Fly" this season.

The Rev. R. Cooper, Swayfield, Grantham, Lincolnshire, reports the crop of Turnips as healthy, and, with the exception of some

patchy places, fully up to a good average, but that in enclosed gardens the Fly was very destructive.

Mr. Hayward, writing from the neighbourhood of Hereford, mentions that there has not been any appreciable injury from ravages of insects, either to corn, seeds, or root crops in that locality during the current year (1882). [In the previous season, 1881, a large part of Herefordshire was shown by the many returns sent in to have been heavily visited by the Fly.—ED.]

Mr. James Edwards, writing from Woodhorn Manor, Morpeth, says—"To the best of my belief there has not been a single Turnip Beetle on my farm, and I have frequently searched for one to show my pupils without success." This locality was one that suffered badly in the previous season ; and the absence of Turnip Fly attack during 1882 is still more remarkable in the southern counties of Scotland, the district of the worst of the attack of 1881.

Mr. R. Service, Maxwelltown, Dumfries, reported that the district of the western part of Dumfriesshire and all Kirkcudbrightshire had been remarkably free from insects. The fine growth of vegetation never gave the insects a chance, and hence the comparative immunity.

Mr. Muirhead, Haddington, says we have had no injury from Turnip Fly in this county this season.

Mr. P. Loney, writing from Marchmont, Berwickshire, N.B., where Turnip Fly caused serious havoc in 1881, mentions that in 1882 this kind of attack was almost entirely absent, and the crop of Turnips in the county the largest that had occurred for many years.

Mr. Malcolm Dunn, writing from Dalkeith, mentioned that Turnip Fly began its ravages in the earlier sown crops, but the heavy and seasonable rains of the early part of June put a stop to the attack.

Crossing now to the West of Scotland, Mr. James Kay, Rothesay, Isle of Bute, mentions that this season the Fly seemed to be almost absent.

At Torloisk, Isle of Mull, Mr. Grierson reports that Turnip Fly did little damage either in the garden or the field, and adds—"I do not remember a season in which we have been so little troubled with insects ; it has been a rather wet summer. *More rain* fell in the preceding summer (1881), but in this (1882) there were *more days* on which rain fell. This was one of the few localities in which in 1881 field Turnips were reported as escaping Fly attack entirely, the heavy rainfall, amounting to 5 inches in June, and 8·80 inches in July, being noted by Mr. Grierson as having forced the plants very fast into rough leaf.

At Colenden, Perthshire, Mr. R. Coupar notices it could not be said there was any attack this year, for the young Turnips got into

rough leaf so fast that they were out of reach of injury before the Fly did any damage.

If we take the above observations in connection with the state of affairs regarding Turnip Fly from 1879, we get a straightforward history thus—

1879.—Unusual amount of wet weather, followed (in various places noted) by growth of charlock, and generally by not being able to get on the land to clean it thoroughly, and thus through 1880 there was both extra food and shelter for "Fly." In 1881 the great burst of heat and drought that came about May was everything that "Fly" could want, or that Turnips could not bear, and we know the consequent losses. 1882 showed early in the season in some places a threatening of attack, but the weather was the reverse of that of the year before; but in almost all the instances reported the "opportune showers," "seasonable rains," or "fine growth of vegetation that never gave the insects a chance" were just what the Turnips needed to run them fast on to the rough leaf, whilst at the same time the rainfall helped to wash some of the Fly from the leaves, and to keep the rest much quieter—that is, much less able to move about when frequently clogged with moisture, and therefore eating and multiplying less than when in heat and drought the creatures are leaping in full activity or on the wing.

The late months of 1882 have been very wet, and though we cannot forecast surely, yet if heat and drought come in May it appears likely Fly will be again very troublesome, and it may be submitted that special attention to the points in the common course of cultivation, which were shown in the Reports of 1881 to be suited to give rapid germination and hearty growth, *could not fail to be of use, and might save great loss.*

Mr. Silvester's notes bear very practically on the different effect of sowing in weather suitable for running the crop on well, or in a dry time.

Mr. F. Silvester, writing from The Hedges, St. Albans, observes—I am glad to be able to report an entire immunity from the attack of Turnip Fly this year in the *Swede* crop. I attribute this to the genial weather at the time the bulk of the crop was sown, germination and after growth being of too rapid a character to render the young plants liable to injury.

I was rather later in sowing White Turnips than usual, owing to a protracted hay time, and as dry weather set in after the seed was sown the Fly gained too strong a hold, and only half a plant was the result.

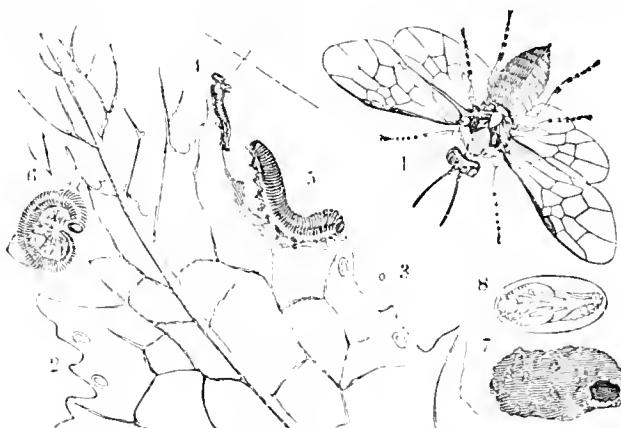
The following remarks were the only notes that I have received as to attack, together with means of prevention:—

Mr. Allen, of Thurmaston, notes that having ten acres of Turnips

much attacked by Fly and Wireworm he had the field rolled over early in the morning (whilst the dew was on the ground) four different times. This saved the Turnip by crushing the flies into the ground with the roller, and also by dirtying the leaves, and the crows took the Wireworm.

Mr. John Box mentions that at Farningham he has seen sawdust mixed or worked with gas-tar, so that it could be thrown as a dressing by hand, prove serviceable in checking attack on several acres of Turnips. The field so dressed was saved, whilst the plant in the adjoining field was entirely lost, excepting on the ground nearest the dressed field, which appears to have thus partially benefited by reason of a sharp wind blowing towards it at the time of hand sowing the dressing.

Turnip Sawfly; "Niggers." *Athalia spinarum*, Fab.



Caterpillars, pupa, and pupa-case. Sawfly magnified, with lines showing nat. size.

A slight attack of this Sawfly is mentioned by Mr. Geo. Brown as occurring at Watten Mains, Caithness. It is noted "the damage sustained was but trifling, still where they were at work can easily be seen, as there is nothing left of the leaves but the ribs.

Turnip Weevil. *Ceutorhynchus contractus*.

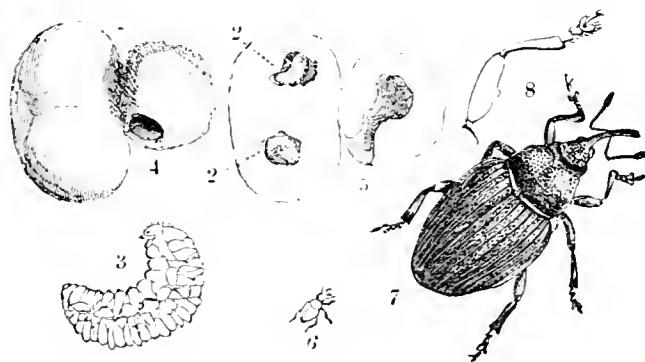
Mr. Geo. Brown mentions that at Watten Mains, Caithness, they were again visited this year by the small Weevil, *Ceutorhynchus contractus*, which was so destructive in the season of 1881. These first made their appearance on early-sown Swedes, but owing to fine growing weather the plants got rapidly forward, and were fit for singling before the insects could do a great deal of damage. This, however, was not the case with the later sown Yellow Turnips, which suffered very much from the attack of this pest, a great breadth

throughout the country being almost entirely destroyed, and on the observer's own farm a field of twenty acres was badly injured. It is noted that whilst fields sown about the same date—that is, the 25th June—suffered severely, that others sown earlier or later escaped entirely. This is considered to point to weather influence, more especially as it was observed that a few days after the Swedes were sown there was a week of intense heat, which would at once be favourable to the insects, and keep the tender baird back under their power.

In the case of a field of Yellows attacked it was thought best to allow the crop to remain, as the season was too far advanced to re-sow with any chance of success. In a short time it came into rough leaf, yet still the insects went eating off nearly as much daily as the growth made, so that the crop remained stationary during a period of eight days. Moist warm weather then brought the crop on, but for a long period they did not assume a healthy appearance, and at the date of writing, late in the autumn, the state of the crop was disappointing.

In the very careful account given by Mr. Geo. Brown of the attack of this Weevil in 1881 (see Report, pp. 102—105) it is noted that benefit occurred from dusting the attacked plants with quicklime, also that the amount of Weevil presence was less where gas-lime had been used as a dressing in the previous autumn, and more where the land had been foul with charlock.

* The figure here given of the Turnip Gall Weevil, the *Ceutorhynchus sulcicollis*, gives a fair idea of the above-mentioned kind.



1—5, Gall with maggots nat. size and magnified; 6 and 7, Weevil, nat. size and magnified; 8, leg of Weevil, magnified.

INDEX.

- Abraxas grossulariata, 64
Alkali waste, 44, 45
American blight, 1
Anthomyia betæ, 9
 " ceparum, 77
 " floralis, 10
 " platura, 77
Anthonomus pomorum, 2
Aphis, Bean, 8
 " Cherry, 13
 " Hop, 67
 " Woolly, 1
Apple-blossom Weevil, 2
Ash-bark Beetle, 4
 " winter tunnels of, 3—5
Asparagus Beetle, 7
Athalia spinarium, 95
Bean Aphis, 8
Beet Fly, 9
Birds, may be too numerous, v
Black Dolphin, 8
" Black Jacks," 74
Boll of Barley, 54
 " Oats, 54
 " Wheat, 25
Bone dust, 60
Breast ploughing, 29
Bush harrow, 53
Cabbage-root Fly, 10
 " various kinds of, 10
Cabbage Butterfly, 9
 " Moth, 11
Carrot Fly, 11
 " treatment to prevent, 12
Cecidomyia (? albilabris), 89
 " tritici, 19
Ceutorhynchus contractus, 94
 " sulcicollis, 95
Cheimatobia brumata, 3
Cherry Aphis, 13
Chlorops tæniopus, 17
Click Beetle, 22—25
 " egg laying, to prevent,
 26—28
Clover-root Weevil, 13
 " history of, 13, 14
 " loss from, 14
Coccinella septempunctata, 67
Cockchafer, 85
Cockchafer, in Fir plantation, 85
Collier, 8
Composts, 12
Crane Fly, 16
Crioceris asparagi, 7
Cuckoo Fly, 73
Daddy Longlegs, 16
 " " grubs cleared, 17
Death's Head Moth, 90
Depressaria Heracleana, 80
Dissolved bones, 35, 58
Elater (Agriotes) lineatus, 22
 " " obscurus, 22
Euacanthus interruptus, 73
False Wireworms, 50
Frog Fly, 73
Gas-lime, 26, 32, 44, 59, 63, 86
 " and Tobacco, 63
Gas-tar, 94
 " water, 45
Gooseberry Caterpillar, 64
 " Sawfly, 64
Guano, 30, 35
Handpicking, 49, 50
" Haulm Fly," 17
 " " winter brood of, 18
Healthy growth important, 32—35
Hellebore, 64, 65
Hop Aphis, 67
 " " on Plums and Sloes, 70
Hop blight, loss by in 1882, iv
Hop Cone Maggot, 71
Hop Flea Beetle, 71
Hylemia coaretata, 20
Hylesinus Fraxini, 4
Hylurgus Piniperda, 84
Isle of Man, Observations from and
 Tables, 54—63
Julus Worms, 50
Kainite, 34, 43, 44
Lady Bird, 68
Leek Fly, 77
Lime, 26, 27, 32
 " and Salt, 79
 " and Soot, 64, 65, 79
Liquid manure, 59
Lophyrus pini, 88
Losses by insect ravage, iv
Magpie Moth, 64

- Mamestra Brassicæ, 11
 Mangold Fly, 9
 Manures, 57, 63
 ,, farmyard, 35
 ,, preventives for Wireworm attack, 32—35
 Melolontha vulgaris, 85
 Millepedes, 50
 Moles, 53, 86
 Mustard, preventive for Wireworm, 38, 39
 Mustard Beetle, 74
 Nematus consobrina, 66
 ,, habits of, 66
 ,, prevention of, 67
 Nematus ribesii, 64
 "Niggers," 95
 Nitrate of Soda, 27, 34, 35, 44
 Oak Leaf-roller Moth, 77
 Onions, earthing up of, 78
 Onion Fly, 77
 Paraffin, 1, 2, 65
 ,, and water, 65, 80
 Paring and burning, 29
 Parsnip Seed Moth, 80
 Pastures, breaking up of, 27—32
 Pea Weevil, 81
 ,, history of, 82
 ,, losses from, 83, 84
 Phædon beiulae, 74
 ,, Coehleariae, 74
 Phyllotreta nemorum, 90
 ,, undulata, 90
 Pheasants, 53
 Phorodon humuli, 67
 Pieris Brassicæ, 9
 Pine Beetle, 84
 ,, Bud Moth, 86
 ,, Sawfly, 88
 Polydesmus complanatus, 50
 Psila rosæ, 11
 Psylliodes attenuatus, 71
 Rape-cake, 33, 46, 48, 49
 ,, action on Wireworms, 47, 48
 ,, Indian, 46, 47
 ,, Black Sea, 48
 Rape-dust, 49
 Rape-meal, 47
 Red Maggot, 19
 Retinia Turionana, 86
 Ribbon-footed Corn Fly, 17
 Rolling, 31, 36—38, 61, 94
 Rooks, 51, 52, 55, see "Tables," 86
 Rubbish-burning, 30, 31
 Salt, 27, 32, 42, 43, 57
 ,, and paraffin water, 12
 Sawflies, 64, 88, 94
 Schizoneura lanigera, 1
 Seaweed, 50, 51, 55, 60, 62
 Sheep, treading by, 27—31, 36, 37
 Sitona lineata, 81
 ,, puncticollis, 13
 Soda and water, 88
 Soap-suds, 1
 Soft-soap, 1
 Soot, 34, 61
 Sphinx Atropos, 90
 Spruce Cone-gall Midge, 89
 Strig Maggot, 71
 Superphosphate, 27, 30, 34
 Syringing, 8
 ,, Sulphur and Soot, 8
 Tables, 56—63
 Tipulæ, 16, 17
 ,, grubs cleared by hand-picking, 17
 Tortrix viridana, 77
 Treading ground, 36-38
 Turnip Flea Beetle, 90
 ,, Fly, 90
 ,, Sawfly, 95
 ,, Weevil, 95
 Weevil, Apple Blossom, 2
 ,, Clover Root, 13
 Weevils, 2, 13, 81, 95
 Weybread, notes from, 53
 Wheat Bulb Fly, 20
 ,, account of, 21
 ,, loss from, 21
 Wheat Midge, 19
 ,, burning dust containing, 19
 ,, date of appearance, 19
 ,, loss from, 19, 20
 Winter Moth, 3
 Wireworm, 22
 ,, in dung, 36
 ,, in Hop land, 48, 49
 ,, life history of, 25
 ,, nature of soil attacked, 57—63
 ,, losses from, 23—25, 53,
 ,, 54, see also "Tables"
 Wireworm Report, 22—63



